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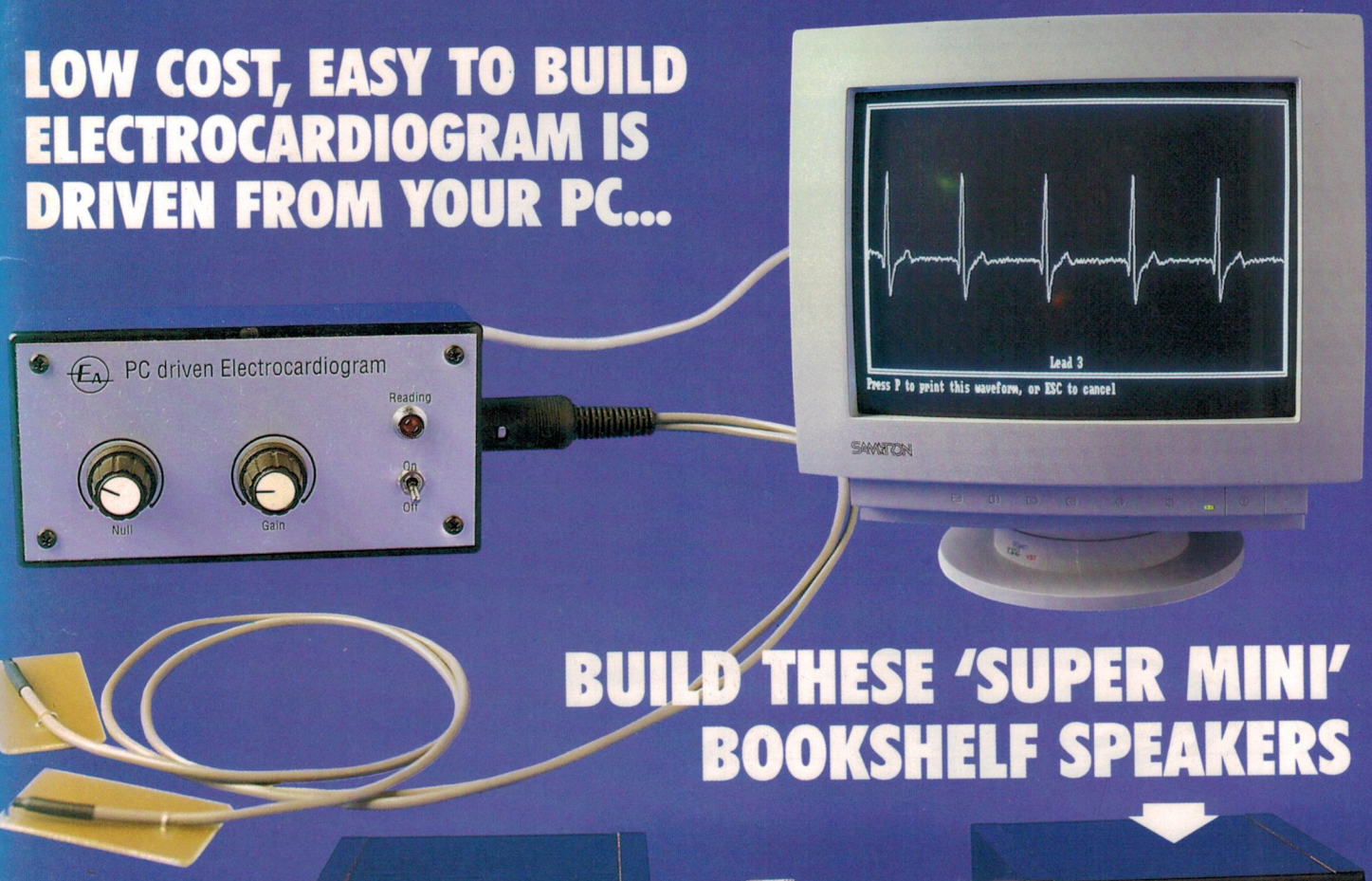

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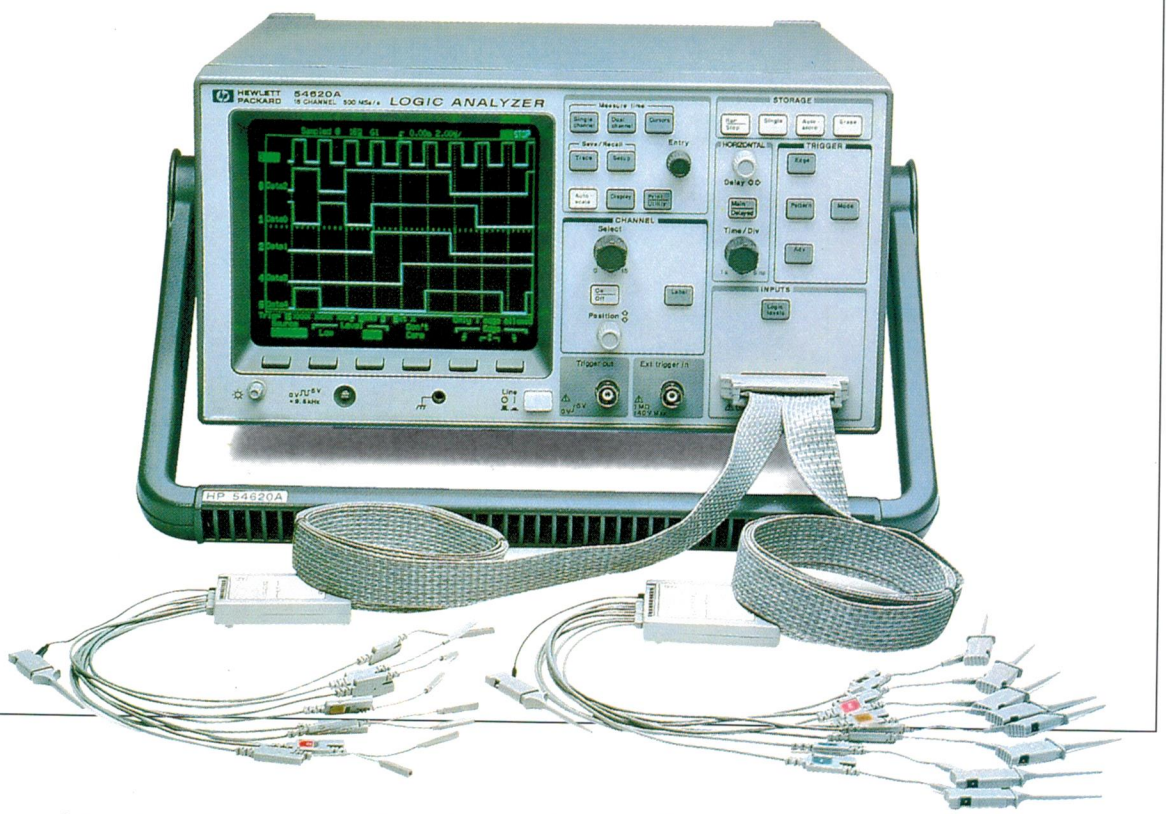

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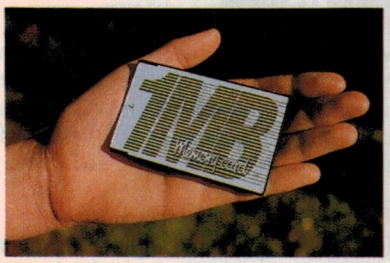
Volume 57, No.7
July 1995

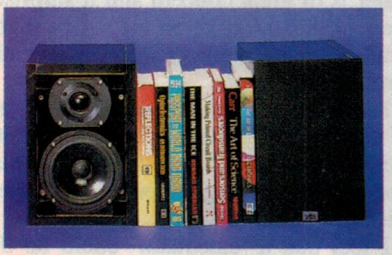
AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

'Credit card' peripherals



Owners of laptop and 'palmtop' computers are no doubt aware of the growing range of credit-card sized PCMCIA plug-in peripherals that have been developed for them. But how do they work — and just what is available nowadays? Tom Moffat explains how PCMCIA works, in his story starting on page 30.

'Super mini' speakers



Available as a kit, Jaycar's compact new JV20 speaker system uses Vifa drivers and is capable of very impressive performance. The drivers are also well shielded, making the system very suitable for use with 'multimedia' computers or in a home cinema installation. For details, see our story starting on page 78.

On the cover

Shown in our upper pictures are this month's PC-driven Electrocardiogram project, designed by Graham Cattley, and the kind of display it can produce on a PC's monitor. (See page 56) At lower right are Jaycar's JV20 'Super Mini' kit speakers, as presented in this issue starting on page 78. (Photos by Ben Duncan.)

Video and Audio

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Projects and Technical

Professional Electronics

Columns and Comments

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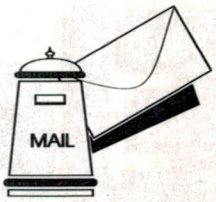
LETTERS TO THE EDITOR



Engraving pen?

I am enquiring if there are any circuits or any information available on constructing an electric marking pencil, for engraving metals.

The engraver I am referring to was described around about 25 years ago. It worked off a car battery and arced the inscription into the metal, giving a better result than modern day engravers — especially on hardened tools.

The pencil worked on an electromagnet with the core arcing dots close together.

Any information would be appreciated.

Ross Tibbey,
Bundaberg, Qld.

UPS project

I have a project suggestion for your magazine. I was reading a recent article about a new range of uninterruptible power supplies for PCs and thought that this would make a good project.

Use either a car or motorcycle battery as a simple or cheap storage device. Since almost all PC equipment uses the ubiquitous switch mode power supply, the output stage could be a fairly simple design without the need for complex wave shaping.

With the vast majority of your readers using home PCs, I am sure that would be a popular project.

Thanks for a great magazine.

Jeff Brown,
Hampton, Vic.

Comment: We'll give it some thought, Jeff. Commercial units are quite competitively priced, but it may be possible to come up with an appealing design.

Superfuser

I read Peter Phillips' review of 'The Superfuser' with great interest. This seemed to be a great device for anyone making a reasonable number of PCB's, but the price tage of $495 seemed a bit steep.

The review gave me an idea I hadn't previously thought of — maybe an ordinary clothes iron would do the transfer process. After some experimentation with heat settings (the maximum setting was the best) I obtained results virtually identical to those in the review. The PCB's worked fine but the etched panels not so well.

I've tried to obtain some of the special paper but haven't been able to contact Palmtech in Boulia. Perhaps the address and phone number given in the review was incorrect. Anyway plain paper in my Apple LaserWriter works well for boards.

James L. Green
Glen Waverley, Vic.

Comment: The address given was correct, Mr Green, but a 'gremlin' seemed to delete a part of the phone number. Palmtech's full number is (077) 463 109, while the fax number is (077) 463 198.

Tide calculator?

I am writing in the hope that one of your readers may have submitted a project involving the calculation of tides.

As you are possible aware, the daily Tidal data is available through the Tidal Authority of Adelaide University and appears as predictions of the times and heights of all tidal cycles throughout the years and are readily available in appropriate publications.

For mariners and all others who go to sea for pleasure or profit, the depth of water is of great concern and it surprises me that this information cannot be made available more publicly and conveniently through electronics.

I understand that here in Brisbane one of the TV stations uses a sub-carrier with suitable modem to decode the information which can then be printed or otherwise displayed.

I feel that a 'calculator' could do the job in view of the simplicity of the calculations involved.

Would you give consideration to asking your readers for some interest in such a project? I, of course, would be pleased to correspond with any interested experimenters.

Capt. Richard C. Hope,
1 Palm Court,
Ormiston, Qld. 4160.

VCR problem

I sent the following letter to National Panasonic, but never received a reply. Perhaps another reader could offer advice...

My NV-G11A video recorder develops horizontal streaks after approximately 1/2 hour. I traced the problem to the power supply, IC 1001 (STK5331), but primarily to the transistor QR6005 which

switches IC 1001 on and off. I replaced both, but to no available.

It works normally without the cover, but the heat build up in transistor QR6005 (DTC114EA) is causing the problems in the power supply IC. The voltages on IC 1001 seem to be normal and within the limits. Covering QR 6005 until streaks appears (1/2 hour) and then just lightly blowing onto it brings it back to normal. I have replaced transistor DTC114EA twice already.

Any advice would be appreciated.

K.H. Weichselfelder,
5/174 Power Street,
Hawthorn, Vic. 3122

Battery voltages

As an electrician who has had some experience restoring and keeping older cars on the road, I would like to buy into the discussion in recent issues:

1. Most cars built prior to about 1950 seem to have had the positive battery terminal earthed; though not all, some were even double wired. This applied to both six and 12 volt systems. (The American Dodge Bros. car has a 12 volt positive earth system on all except the last models.)
2. The polarity of a generator is determined by its residual magnetism and can be corrected by energising the field from a battery. Care needs to be taken not to damage the cut-out or voltage regulator if fitted.
3. Connecting the generator as a motor will polarise it and indicate its direction to be run as a generator (both are the same). It will not self-excite in the reverse direction. You have to reverse the fields or the brushes.
4. Battery polarity can be reversed (see April issue).
5. Most important, do not be surprised by anything someone has done in the past — check it.

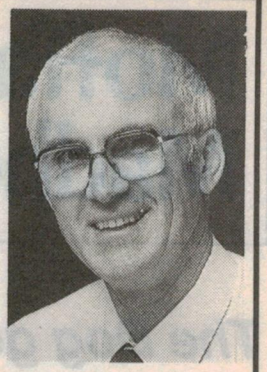
In the 'strange but true' department, I once found a brass grub screw in a brass metal block of a fuse holder. The screw was live and in contact with the wire in a hole in the brass block, but there was an open circuit between the wire and the block!

Thanks for an interesting magazine.

Peter Hunt,
Narrandera, NSW.

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We reserve the right to edit letters which are very long or potentially defamatory.

EDITORIAL VIEWPOINT



Mixed feelings about the future of 'Pay TV'...

I don't know about you, but I have mixed feelings about current developments in the way we're moving towards digital multimedia distribution — not just in Australia, but globally.

In many ways, I see the developments as extremely positive and worthwhile. We're seeing exciting new industries being created, and with them the potential to employ large numbers of people in skilled and satisfying jobs, both technical and 'creative'.

On the technical side, there's also the challenge of entering an exciting new era of rapid change, when digital processing and communications technology will provide the potential for an enormous range of enhanced and additional services. As Nicholas Negroponte of MIT's Media Lab predicts in his new book *Being Digital*, the next 10 years are almost certain to see dramatic and revolutionary changes in many areas of our established 'media' — radio and TV broadcasting, newspapers and magazines, books, videotapes and discs, CDs and audio tapes — as well as in the 'communications services' like phones, cellular phones and faxes.

Until now, these areas have been seen as quite distinct and separate. But in 10 years' time (possibly less), the distinctions will have blurred and they'll be seen merely as various ways of sending or receiving the information we want, and/or experiencing the kind of entertainment we want — in whatever form, and at whatever time we want it. The concepts of 'broadcasting', 'publishing' and 'communications' will have merged.

Why, then, the mixed feelings? Mainly, I suppose, because many people seem to be approaching these developments in a very short-sighted way. Even the quoted comments by executives of the new media firms suggest that in many cases *they* see 'Pay TV' as the main agenda, and often as little more than the opportunity to peel extra money from the population by offering umpteen extra channels of sport, 'infotainment' and further recycling of movie libraries...

One of my concerns is that this kind of thinking will cause a lot of needless waste of effort and resources, and probably delay many of the aspects of the digital multimedia revolution that will ultimately bring the greatest benefits.

Consider, for example, the 'set-top boxes' that are beginning to appear in our homes. In the long run, these will need to act as an interface for a plethora of interactive digital information services, and be built into 'intelligent' systems that can be automatically configured for a wide range of display, presentation and/or communication modes. But the boxes that are being installed *now* have almost no potential for any of this, being dedicated exclusively to subscription TV — and generally only in the particular form delivered by the company you sign up with.

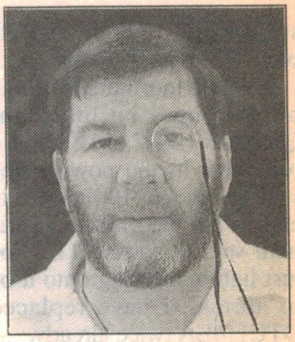
If you want more than one kind of service, you'll need additional boxes. And the present boxes don't even seem to provide 'baseband' video and audio outputs, to allow the best quality analog viewing — let alone a digital interface to allow for the inevitable future developments.

My other concern here is that with so many big media and computer firms jockeying for a slice of this new area, lack of foresight may see us end up with many of our future interactive services controlled by a small number of enormously powerful global conglomerates.

Jim Rowe

Moffat's Madhouse...

by TOM MOFFAT



The Dog goes all modern and electronic

From time to time in this column, you've heard mention of the Burglar's Dog jazz band of which I am a member. It's probably a good thing to have wider interests than just electronics, and music is a good alternative. In fact I've met a lot of electronickers who also indulge in music, either by listening to it or playing it.

So, playing with the Dog is what I do every Thursday night, as well as some weekends. In fact detractors to some of my writings have suggested that I should stick to playing in pubs and get out of electronics altogether. Well, that just shows they haven't heard Burglar's Dog. (Only joking!)

Burglar's Dog is now in its 16th year, with four of its eight members having been there the full distance. I'm just the youngster, with six years' service. All members have either some gray hair, or very little hair at all.

Such a stunning collection of old codgers is steeped in tradition. The band has always been strictly acoustic, with instruments such as trombone, saxophone, clarinet, guitars, banjo, mandolin, acoustic bass and drums. My part in this is piano, accordion, sometimes guitar and mandolin, and a makeshift slide-saxophone contraption which has become known as a blastophone. (I might do a construction article on that, one day...)

As Burglar's Dog slowly dribbled into the electronic age, playing in pubs, it became obvious that certain concessions to progress would have to be made. The first was that singers were going to have to use microphones. Previously vocal amplification was via a 1920's-style megaphone, which is still used for outdoor gigs.

The next outrage, again as a concession to the pub environment, was amplifiers for the guitars. This was achieved by adding magnetic pickups to our existing steel-string acoustic guitars. I was rather pleased with mine; the pick-up gave it a big fat 'meaty' sound that was ideal for blues work, and even better for country & western and bluegrass. I didn't make too big a deal of this, though, because amplified guitars still didn't go down too well with the traditionalists.

The final blow to the Dog's acoustic purity came when we got a job for several months at Hobart's Wheatsheaf Hotel — unfortunately now gone to pub heaven, taken over by a car showroom. The Wheatsheaf had an enormous on-stage PA system (see Madhouse, June 1992), and we were expected to use it fully. Mikes on every instrument and every singer. Oh, boy, did we make some noise then! I thought it was great, especially playing blues through that guitar plugged into a 500 watt amp, and 15-inch speakers.

What the Wheatsheaf *didn't* have was a piano, so my own keyboard activities were restricted to the accordion. In fact few pubs, in Hobart at least, have pianos, and they are becoming rarer all the time. I see two reasons for this. One, most pub bands nowadays play rock, and modern rock doesn't use piano (not like the Jerry Lee Lewis days). Secondly, when a pub is sold it seems any piano there is sold separately; or it goes along when the previous owner moves out, and the new owner sees no reason to purchase a new piano.

In previous days Burglar's Dog has stuck pretty much with blues and jug-band stuff, with occasional forays into mild country & western and some 'world music'. The accordion was fine for this; in fact any blues number played on the accordion instead of piano comes out as zydeco, which is becoming a pretty trendy music style in itself.

But of late, the Dog has been moving into more sophisticated jazz styles, many based in the 1930's and 1940's. Here the accordion is no longer the jack of all trades. Nothing sounds more ridiculous than Fats Waller's version of 'Your Feet's Too Big' played on an accordion. We needed a *piano*, real bad.

It just so happened that I had one of those electronic keyboard things, inherited from relatives in America. It was made by the Lowrey Organ Company, and as such it produced some pretty convincing organ noises along with tremolo and chorus effects, in stereo. It had automatic accompaniment and automatic bass and automatic this and automatic that, and once you mastered the various controls you could play it with one finger on each hand while the computerised goodies within did most of the work.

All the whizz-bangs could be disabled, leaving you with a 'full keyboard' and a selection of various instrument effects — one of which was a piano, sort of. In desperation one day, I took the Lowrey along to a Burglar's Dog practice, and announced, "Well boys, here's our new piano".

But after we tried it with a few numbers and with everyone yelling "Yuk!", it became obvious the Lowrey was more imagination than piano. What it really sounded like was a synthesiser trying to *be* a piano, in the finest Japanese tradition.

So the Lowrey was banished back to Moffat's Madhouse, written off as a bad joke. The accordion was re-established as the Burglar's Dog keyboard instrument, honking its way through classic 1930's jazz arrangements. Phew! It was awful, and the other band members came to hate it even more than the Lowrey. So the Lowrey was grudgingly accepted, as a 'piano of last resort'...

Then, late last year I made a trip to the USA, spending some time with an aunt and uncle in Washington state. Uncle Charlie was a retired gold miner, bush pilot, slot machine mechanic, inventor, casino shill, and musician. He had recently bought a modern electronic keyboard with which he regularly entertained the troops at his local Elks Club. I had a little play with this keyboard, kicked it into piano mode, and — Hey! it sounded like a piano!

Right, I was going to get one, right then and there. So Uncle Charlie and I went back to the discount house where he had bought his keyboard — only to find that it was a superseded model, no longer available. I decided then that I would make it my quest in the USA to find some other model of keyboard that actually sounded like a piano.

During travels in Washington, Colorado and New Mexico, I hit every music store I could find, trying out this and that keyboard. There was some mighty good stuff; Yamahas and Rolands and Korgs, all with pianos of one kind or another. But, judged only on the quality of its piano sound and nothing else, one came out on top: the Korg X5.

I was ready to buy one, but then I started worrying about getting it back to Australia, dragging it through three airline flights and five different airports. A keyboard is not a small item; I was already heavily laden, and I worried about the excess baggage police. So I left the Korg behind.

As it turned out Ansett busted me for excess baggage anyway in Melbourne, on the last leg of the journey. I'd hate to think what it would have cost if I'd had a keyboard in tow as well...

Back in Australia, a ring-around of music suppliers soon produced a Korg X5, which was duly taken along to a Burglar's Dog practice. With great fanfare I announced that the piano problem had finally been solved, and just to prove it I launched into 'You're Feet's Too Big'.

"No!", they said, "that's no good. Take the echo off!"

And here came one of my first lessons in electronic music. That Korg 'piano' that had sucked me in so completely, was in fact a concert grand model situated in a large auditorium. On its own, fantastic, but combined with the rest of the band, playing in a small room, it just didn't make sense. No problem, I just re-programmed the piano.

And that was lesson number two. With these latest electronic keyboard thingos, you can re-program just about anything. You start with a basic musical instrument, stored in ROM. On the Korg there are over 300 of them, and each one has been sampled into the system at 32 different intensity levels. So the instruments are not synthesised, they are recordings of the real thing.

Building upon the basic 'raw material' instrument you can adjust such things as the attack and release times, the frequency spectrum, and the acoustic environment as specified by reverberation times.

What we really wanted for Burglar's Dog was an elderly iron-frame upright piano, as much as possible like the one in Hobart's Sixty-And-Over club. This is recognised among local jazz musos as probably the best piano in Tasmania, even better than the Yamaha concert grand on the stage at Wrest Point Casino.

So a new 'program' was created (the Korg will store 100 user-created programs at one time). We took one of the ROM-based pianos (there are several) and applied two kinds of reverberation: long-term restricted to a small room, and short-term to simulate the sound reflections that take place within the piano's own case. The result was stored forever more as 'Burglar's Dog Piano'.

The piano problem has thus been solved, although it has been necessary for Burglar's Dog to swallow its acoustic pride and bend with the times. However we have made a vow that whenever we are playing somewhere there is a REAL piano, we will use it in preference to the Korg, to try to hold on to even a little bit of the band's acoustic integrity.

Back in the house of Moffat, the Korg sits in the place where the Lowrey used to be, beguiling me with some of its other charms. You see, these newfangled contraptions can be hooked up to a computer. It's all in the name of MIDI (Musical Instrument Digital Interface), which I didn't give a hoot about before. Computerised sound I'd heard previously consisted of synthesised music coming out of a PC as accompaniment to games, or even as tunes on their own. But still, little more than a flashy synthesiser.

I didn't see myself ever trying MIDI, mostly because you needed a MIDI card or a SoundBlaster card or something which must plug into a slot within a computer. And as a laptop user, I ain't got no slots...

But the latest Korgs, and possibly other brands, now have a PC interface which plugs straight into your computer's serial port. No extra card is required, only a simple driver program to trick the computer into thinking the serial port is a MIDI port.

With a software package called a 'sequencer', the keyboard, or computer sound card for that matter, becomes the modern equivalent of a pianola. The music comes as a MIDI computer file, instead of on a paper roll. Files are freely swapped among users.

One I collected from the Internet is a recording of Scott Joplin's 'The Entertainer' which has two musicians (a 'four-hand' arrangement in piano-roll parlance) playing the one Burglar's Dog Piano, or the concert grand, or anything else you choose.

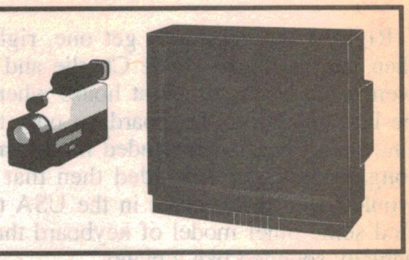
One pianist is playing the melody, and the other does the accompaniment. But unlike the traditional pianola, you can switch off one of the musos and replace him with yourself, playing along on the keyboard with the electronic muso who's still there. For people who can't read music (like me) this is an excellent way to learn new songs. I managed to tweak up my own version of The Entertainer by playing along with these two electronic pianists, one at a time.

But wait — there's more! (as they say in the TV commercials). A full-blown MIDI implementation can make the computer play up to 16 instruments in the keyboard's synthesiser, simultaneously. So you can get a full band or orchestral arrangement with a string section, a horn section, a 1950's Hammond organ, drums, bass, guitars, and voices going "do-do-do". I'm not really into Michael Jackson's stuff, but I've got a MIDI file called 'Thriller' that's just out of this world...

And still more! (You ain't seen nothin' yet!) The Korg X5, although an enormously powerful instrument, is still the baby of the range. I have just accepted an invitation to a function at which the latest you-beaut rip-snorter Yamaha keyboard is to be launched onto the market. I have no idea what this thing is going to do, or sound like, but I would say there are surprises in store.

Stay tuned for further developments; I think I feel some more articles coming on, perhaps delving deeply into the wondrous technology behind these fantastic music machines. ❖

What's New in VIDEO and AUDIO

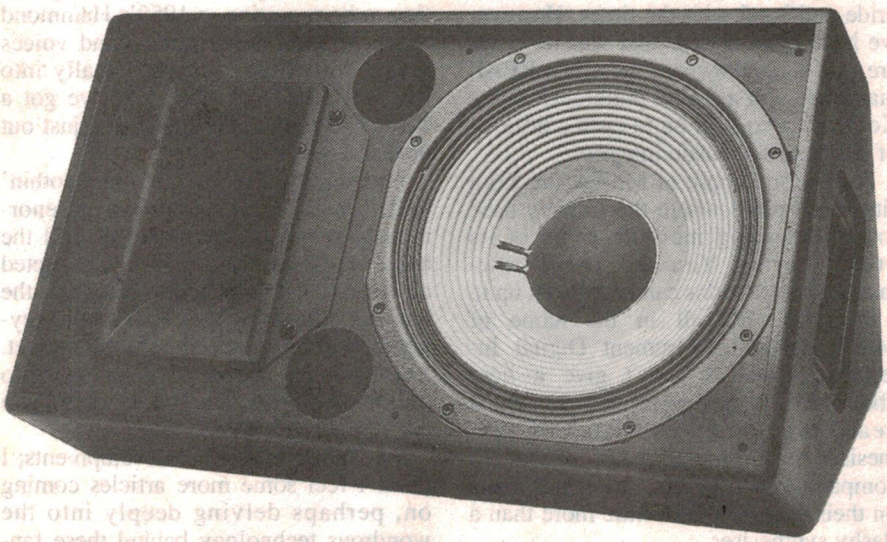


JBL stage monitor speakers

JBL has expanded its Array Series line-up with the addition of two new stage monitors — the vertically orientated 4890 and the horizontally orientated 4891. The 4890 and 4891 are high power, high performance stage monitor systems with identical transducers, extremely high sound pressure level output and very low distortion across the full audio bandwidth.

Both monitors use JBL's new 14" ultra-low distortion neodymium woofer, which incorporates JBL's Vented Gap Cooling. This patented motor ventilation design reduces power compression and results in precise tracking of low frequency transients, even at the extreme limits of power handling.

JBL's 4" neodymium compression tweeter cleanly reproduces the high frequency content with the 1.5" exit coupled to a 60° x 40° optimised aperture horn for a smooth, tightly controlled dispersion pattern.



The vertical orientation of the 4890 provides a smaller stage footprint, while the 'horizontal' 4891 hugs the stage to minimise interruption of audience and camera sight lines. For extra flexibility in placement, the horn in the 4890 rotates to provide either horizontal or vertical high frequency dispersion patterns.

Array Series monitors are designed for bi-amplified operation. In complex monitor systems JBL recommends use of the new DSC490 digital system controller, which provides full signal processing for up to four independent mixes. In limited systems where only two mixes are required, the lower cost analog ASC24 is a suitable replacement.

JBL Array Series are intended for applications demanding the highest levels of sonic accuracy, very high SPL projection, and absolute reliability.

For further information circle 182 on the reader service coupon or contact Jands Electronics, 578 Princes Highway, St Peters 2044; phone (02) 516 3622.

Subwoofer has unusual shape

Kenwood has introduced a subwoofer that is designed for both 'home theatre' A/V systems and also to supplement existing hi-fi audio systems. In stylish 'Beyond 2000' lines, the SW-500 looks more like a cannon than a 50 watt subwoofer system.All that is needed to drive the SW-500 subwoofer is a subwoofer line or preamp output. With selectable roll-off frequencies, gain control, sub bass boost, bass boost and an infra-red remote control that can address all functions, the SW-500 is a perfect companion to any serious home theatre system of hi-fi.

Kenwood contend that the SW-500 also has strong application in hi-fi systems that employ smaller satellite speaker systems, where bass is particularly 'shy'. Being an omni-directional speaker the SW-500 can be installed in almost any location. Since the sub-bass component in music is usually monaural, only one SW-500 is necessary to obtain sufficient sound level when used in combination with a stereo music system.

The SW-500 is covered by a 24 month warranty and is available from all Kenwood dealers. For information on your nearest supplier, circle 181 on the reader service coupon or contact Kenwood on (02) 746 1888.

'Mini monitor' from Duntech

Duntech has just introduced a new tripod, shelf or stand mounted mini loudspeaker which challenges normal expectations for loudspeakers of this size, and is claimed to bring Duntech quality sound to its lowest price ever.

The PCL10 is a diminutive 275mm high, 170mm wide and 226mm deep. But although small in size, it possesses all the characteristics of a pulse coherent loudspeaker — musicality, transient precision and accuracy.

The loudspeaker has one 100mm bass/mid driver and one 10mm tweeter. The drivers are time collimated for a listening distance of 3.5 metres and the small physical size of the loudspeaker ensures 'virtual point source' operation.

The use of first order crossover topology combined with time collimation and virtual point source ensures both time and frequency integration. In addition, the diffraction effects around the cabinet are controlled by carefully placed felt treatment. This combination of features produces Duntech's celebrated pulse coherence, allowing the PCL10 to reproduce a sharp clean step response output.

Due to the use of first order crossovers, each driver needs to have wide bandwidth. The PCL10 driver complement does not disappoint in this respect, employing the very latest technology. The bass/mid driver has a 110mm coated fibre cone, an extremely long throw suspension and heavy copper rings above and below the T-shaped pole piece to reduce nonlinear and modulation distortion.

Fitted with a solid copper phase plug for smooth extended high frequency output, the tweeter possesses a 10mm polymer dome with a balanced drive suspension system. The tweeter voice coil does not use a former and the moving parts are ultra-light (total moving mass is 0.1 grams).

The result of these design features is claimed to be a near perfect amplitude and phase response (excess phase for the PCL10 is +/-25° from 80Hz to 20kHz). The amplitude response is a very flat +/-2dB from 80Hz to 20kHz. The PCL10 provides useful in-room response to below 60Hz (-3dB at 70Hz). Sensitivity is 85dB SPL (2.83V/8 ohm at 1m) and impedance is a well behaved nominal six ohms so this speaker can be used with a wide range of power amps.

The Duntech PCL10 is hand assembled, finished in authentic Australian Jarrah veneer and is intended for stand mounted operation.

The manufacturer's suggested retail price is $1395/pair.

New Technics portable CD players

Four new models in the Technics portable CD player range were recently released by Panasonic. These include two standard models and two car models, supplied with a car power cord and car cassette adaptor.

The top of the line models, the Technics SL-XP470 and its car equivalent, the SL-XP471C have an anti-shock memory system which eliminates the interruption in sound which would normally occur due to mistracking. If a strong bump causes a tracking error, the sound data stored in the electronic memory will continue to play for up to three seconds while tracking returns to the correct position.

The built in Digital Sound Processing of the SL-XP470 and SL-XP471C reproduces sound through four preset modes — Hall, Live, Church and Super XBS for ambience and richness of sound.

The SL-XP470 has a multi-function remote control which is connected to the earphone cable to reach chest height and controls play, stop, tracks, hold button and the four DSP presets functions.

The SL-XP471C features a cordless remote control which can operate the unit in the car or connected to a home hi-fi unit. It also includes a car power cord and car cassette adaptor.

The next model in the range is the Technics SL-XP250C (car model) which has MASH single bit DAC and a double floating mechanism, which assists in absorbing bumps and shocks whilst in the car and minimises interruptions in sound caused by CD skipping.

The final model is the Technics SL-XP170, which also features MASH single bit conversion.

Large screen CTV's from Akai

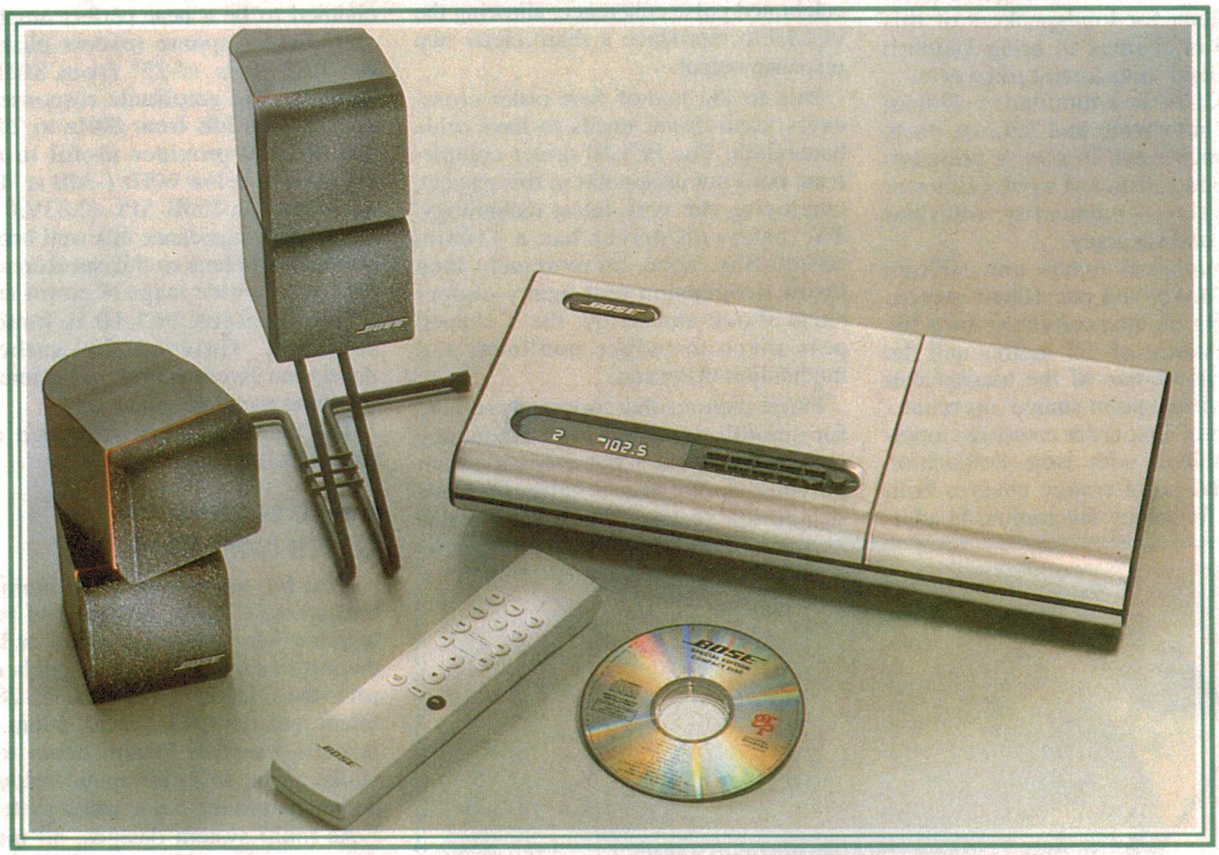
Akai has announced three multi-system stereo CTV's, designed to be integrated with the home audio or home theatre system. The three models comprise the CTK-2976 68cm, CTK-2877A 68cm and the CTK-2577A 59cm. The latter two models feature stereo sound, whilst all models offer audio output for connection to the home audio system.

As multi-system designs, all models are compatible with up to 23 TV broadcast and VCR playback systems including NTSC, SECAM and several PAL formats. (The CTK-2976 is compatible with 26 TV broadcast and VCR playback systems.)

As high definition CTV's, all models offer S-VHS for connection direct to S-VHS and Hi8 VCRs and camcorders. All models benefit from Akai's flat screen technology for lower picture distortion. The CTK-2976 also incorporates an in-built 12 watt RMS stereo amplifier that can be connected to external speakers, allowing for greater stereo separation.

All models feature a program memory synthesiser that tunes all channels automatically and is combined with Akai's auto search tuning feature for efficient, accurate channel tuning. They also include infra-red remote control, dark tint tube technology, an on-screen 'menu' display and sleep function that automatically switches the power off after a set time.

The CTK-2976 (RRP $1399), CTK-2877A ($1499) and CTK-2577A ($1299) are covered by a 12 month warranty and are available at selected Akai dealers and department stores. ❖



BOSE LIFESTYLE LSM5 MUSIC CENTRE

Although our reviewer Louis Challis has previously tested the Bose Acoustimass AM5P MkII powered loudspeaker system (January 1992), we discovered that he hadn't yet looked at the matching LCM5 Lifestyle Music Centre. As this is equally innovative and designed to be 'heard but barely seen', we asked him to remedy that shortcoming forthwith. He did so, and here's his report.

I guess I've lost count of the number of times that friends or acquaintances have asked me directly, "What do you think is the best home music system for me?". As you might guess, the answer to such a complex question generally fails to satisfy the person concerned, because there *is* no simple or straightforward answer.

Of course this issue is so important that numerous other people have been looking at it, but for somewhat different reasons. Their best guesses of what constitutes a 'best system' are often quite interesting, when you see the resulting products.

For example the early Japanese approach of the 1980's involved providing large and visually attractive multi-unit stacked systems. That trend is still around, but the thrust and ultimate direction has slowly changed over the last 15 years. Today the emphasis is on plasma displays and multiple options, all too often designed to match the complexities of 'home video' or 'home theatre'.

As attractive as the latter concepts may be, the truth of the matter is that most consumers still buy a hi-fi system to listen to music, and generally whilst involved in other activities. 'Big' is no longer beautiful, as our houses become cluttered with more and more consumer items.

Like it or not, the average hi-fi system is not what I would describe as 'beautiful', nor would most males or females describe them as being visually pleasing. Now visual aesthetics are clearly important, but the option of being inconspicuous, as opposed to being visually prominent, is frequently more desirable. I have frequently noted that most women want a system which can be heard, but not seen.

To achieve that aim is simply not easy.

Amplifiers are normally large. CD players (apart from portable units) are frequently equally large. Tuners seem to take up almost as much space, even though they shouldn't. The rack or stack of conventional hi-fi equipment often ends up being half a metre high, with a weight to match.

Enter Bose...

When Bose developed their exciting AM5 Acoustimass speaker system, they set the market on its ear.

Here for the first time was a loudspeaker system that wasn't designed to be built into the wall, and which could provide rollicking bass using two pairs of minuscule mid-high direct radiators for mounting on the wall or placing directly on top of furniture.

The response of the market to that development was quite outstanding. Although the speakers did not achieve acoustic perfection, their obvious physical attributes and their lack of visual impact created a niche market out of all proportion to their size.

Of course it's all very good to have a set of *speakers* you can't see, but when the audio source happens to be a large and visually disturbing rack/stack of equipment, the visual advantage is invariably lost. Here is a problem which seemingly had no appropriate solution. No solution, that is, until Bose decided that if the public wanted speakers that couldn't be seen, then there was an obvious demand for a music system that would also be visually inconspicuous.

The amplifier/bass speaker box of the Acoustimas AM5P powered loudspeaker system (the intended 'other half' of the system) is still quite compact, and designed to be placed inconspicuously in a corner of the room.

Lifestyle system

Now the 'Bose Lifestyle Model 5 Music Centre' is visually attractive. Its neat and shiny brushed aluminium design format will ultimately earn it a place in the hallowed halls of New York's Museum of Modern Art. One could be forgiven for thinking that this system had been designed by Bang and Olufsen in Denmark, as opposed to Bose in Framingham, Massachusetts.

On the right hand side is a neat spring loaded cover, below which is the CD player with four buttons for manual tuning and channel pre-set, store and erase controls. You manually load the CD face down, without resorting to slide-out draws, or other fancy gismos.

On the left hand side is a recessed liquid plasma display, which provides pertinent information on both the AM and FM tuners, on the CD player functions and your choice of source input. To the right of the display are 11 pushbuttons.

At the extreme right hand end is the power OFF switch. Adjacent are a pair of arrowed buttons which raise or lower the output VOLUME. Selection of any one of the five other source input buttons (CD, AM/FM, TAPE, AUX, or VIDEO) simultaneously activates the unit as well as selecting that source. The three remaining controls are the PLAY/PAUSE button for the CD player, and FORWARD and REVERSE/SKIP for the CD player.

With only 11 primary buttons, controlling the system is absolutely 'child's play'. (Of course that phrase isn't all that helpful, as children adapt more easily than adults when learning to use new electronic systems.)

If you think these controls are simple, then you really must try out the Bose Model RC-5's remote control. I must acknowledge that I fell in love with the Bose RC-5's remote control.

This is the most sensible, attractive and functional remote control that I have yet had the pleasure of using.

Instead of using an infra-red optical system, like 99% of all the other remote controls currently being marketed, this system uses an RF system instead.

The frequency of the RF system is 'user selectable' by means of an eight-position DIP switch located behind the battery cover. This is particularly important when you have more than one of these systems in the same house, or when your neighbour happens to purchase one like yours (because they also fell in love with your system).

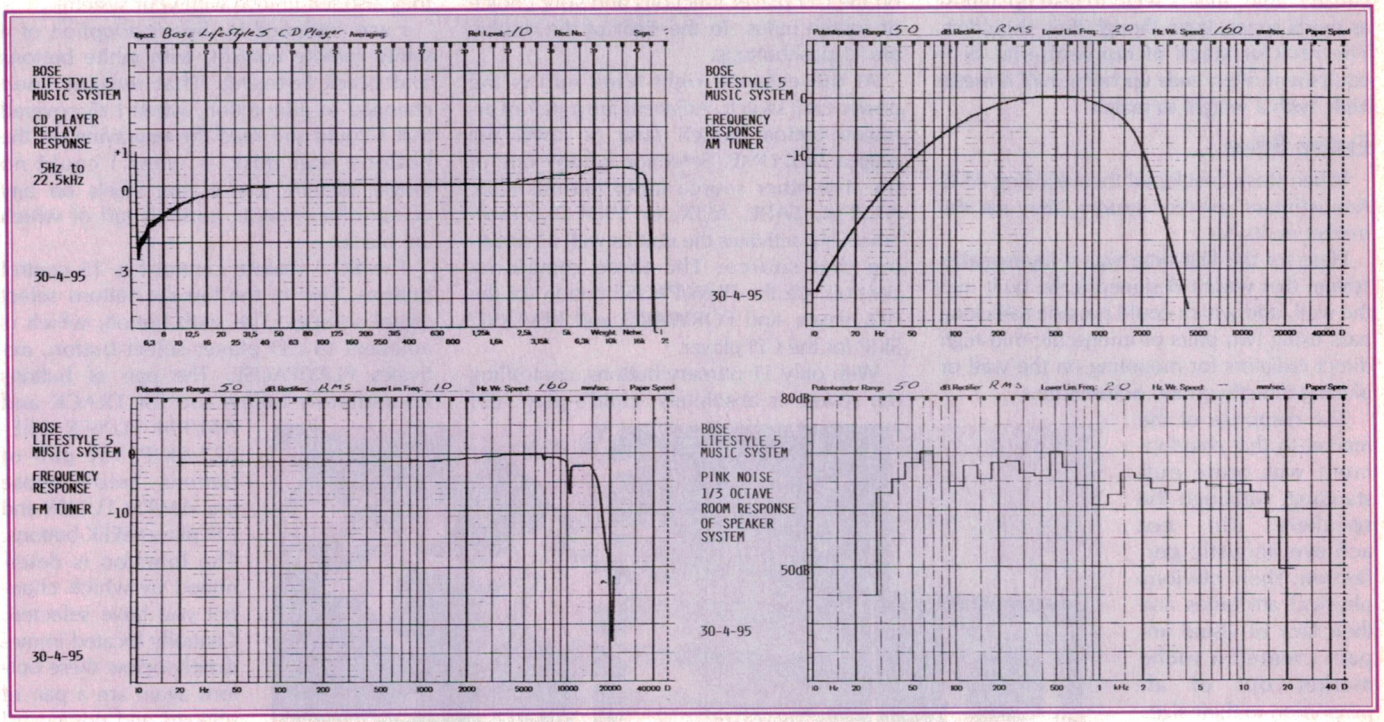
I was intrigued by Bose's adoption of a white remote control, with white buttons and black lettering. That intrigue soon changed to admiration, when I discovered that I could still read the engraving on the buttons after dusk — when I could no longer identify any of the labels on any of my other remote controls (all of which are black).

The RC-5 remote control has 15 control buttons. Five of the top six buttons select signal sources. The sixth button, which is adjacent to CD player select button, activates PLAY/PAUSE. The pair of buttons immediately below are for TRACK and AM/FM TUNER PRESET SKIP. The pair of buttons below those are AM/FM TUNER and CD player SEEK buttons. The function is determined by which channel you have selected. Centrally located immediately below these buttons again are a pair of upward and downward volume control atten uator buttons, labelled with large arrows and having an obvious function.

The three remaining buttons provide AUTO-OFF, which initiates an automatic 75-minute countdown before the sys-tem switches itself off. The auto-switch off duration may be simply reduced by increments of five minutes, the reduction depending on the number of times you press that button.

The only button which is not circular is the MUTE button. This silences the system's speakers when pressed, and re-activates them when pressed again. The last button, and the only button that is not white, is a black button labelled OFF (in white lettering) — which does precisely that, switching off the whole system, (ie. speakers and control system).

Unlike some of the remote controls which I have around my house, which incorporate as many as 90 different functions, and which require repeated training to use adeptly, this remote control proved to be an absolute joy and delight. Other manufacturers should sit up and take notice. Even those that offer multi-functional remote controls should seriously consider offering the option of a reduced function remote control, as convenient as the Bose JRC-5.



These measured performance plots for the Lifestyle LSM5 system show the CD player replay response (upper left), the FM tuner response (lower left), the AM tuner response (upper right) and the pink noise 1/3 octave room response (lower right).

One reason why the Lifestyle Model 5 Music Centre is so small is because it doesn't incorporate any power amplifier stages. These are located in either the Bose AM5P Mark II Speaker Centre (with which the system has been designed to be used), or would alternatively be incorporated in a separate amplifier rack or system as selected.

The rear panel of the Music Centre contains two pairs of colour coded coaxial sockets, for speaker systems 'A' and 'B', and a separate pair of output sockets with fixed output level. Two pairs of input and output sockets are also provided for a tape player. A pair of sockets are provided for AUXILIARY INPUT, and a pair of sockets for output to a VIDEO SOUND SYSTEM. A 75-ohm coaxial input is provided for the FM antenna, plus a pair of screw terminals for the AM loop antenna.

Although a simple dipole FM antenna is provided, I would strongly recommend employing a dedicated commercial roof-mounted FM antenna. An AM loop antenna is also provided, with a simple plastic clip to attach it to the rear panel of the system. My only real criticism of the system was the premature failure of this clip, which broke in my hand whilst I attempted to insert the loop into it.

One neat design feature, which although simple has proven to be effective, was the removal of the mains transformer from the Music Centre. By adopting a separate 240/12 volt 1.2 amp power pack, the designer's space problem has been deftly avoided.

The power pack is manufactured in Germany to tight EU standards. It comes complete with a nominal 4m length of lead, with a conventional coaxial battery plug at its outer end.

Powered speakers

In its preferred format, the Music Centre is interconnected to the AM5P powered Acoustimass bass speaker enclosure by means of a cable of 5m nominal length. The cable has a DIN plug at the amplifier end, and two RCA sockets and control lead at the Music Centre end. The control cable switches the power amplifier on and off as well as the speaker system, using either the remote control or the OFF button on the front panel of the Music Centre.

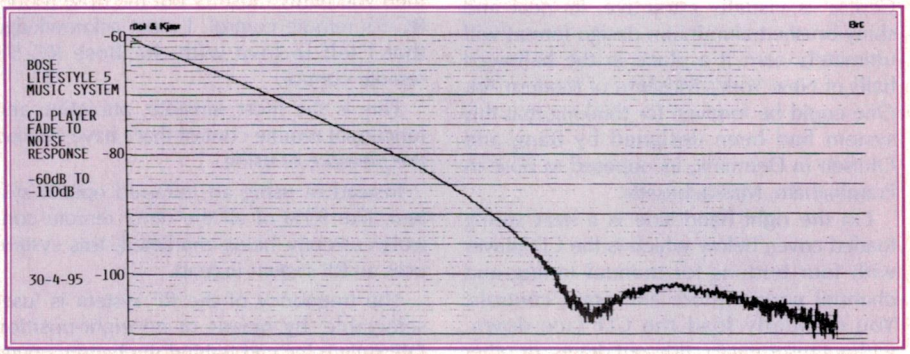
Two additional very long speaker cables are provided, so that the satellite mid-range/tweeter units may be hooked up at remote positions within the same room.

The speaker system as supplied did not incorporate either brackets or stands for the remote speakers, as those are optional extras. I subsequently discovered that either the brackets or stands are required to achieve optimum placement and functional performance.

Objective tests

I decided to restrict the primary objective testing to the Lifestyle LSM5 Music Centre, as I had previously evaluated the Acoustimass AM5P Mark II speaker system.

My starting point was an evaluation of the CD player. Its frequency response is quite smooth, extending from 5Hz to 20kHz



Shown here is the 'fade to noise' response of the CD player in the Lifestyle LSM5 music system, from a level of -60dB down to -110dB.

+0.6dB/-3dB. The 0.6dB rise between 2kHz and 20kHz is purely of academic interest. The droop at 20Hz is only 0.2dB, and as a consequence the frequency response in the range of normal hearing, or within the output range of the speakers is relatively flat.

The linearity of the CD player is excellent down to -60dB and still reasonable at -70dB, but as the fade to noise test shows, is far from linear at lower levels.

Unlike most other systems which I have evaluated, the drooping response appears to be an intentional feature. I feel that this characteristic, of a lower output level in the range below -90dB has been organised so that residual noise will be reduced (emulating some of the characteristics of a Dolby 'B' or 'C' noise reduction system). Irrespective of what you or I may think of that approach, this system is so quiet that with a CD playing, there is no trace of low level noise.

My evaluation of the distortion characteristics at the output terminals of the LSM5 Music Centre furnished results which matched the output linearity curve. The total harmonic distortion, down to 60dB, was less than 1%. At -70dB the distortion had climbed up sharply to 5.9%. That is significantly higher than the distortion figures displayed by most other CD players in that region. At -80dB the distortion was still only 7.5% (which is bordering on the normal). At -90dB the distortion had jumped to -44%, which is not at all surprising.

The higher than normal distortion at -70dB is not a matter of great concern, as distortion components at those low levels would not normally be audible. They should be effectively masked by other sounds on the disc, as well as by background levels within the room.

The evaluation of the FM tuner revealed that its frequency response to 10kHz was +1dB, but between 10-11kHz there was an obvious notch in its frequency response. The frequency response then extended out to 15kHz at the -2dB level. Beyond 15kHz the frequency response dropped away fairly rapidly, which is quite normal.

The sensitivity of the FM tuner for 50dB quieting on mono was 15dBf. On stereo, the sensitivity was 38dBf. Both of these sensitivities are reasonable, but not outstanding. The signal to noise ratio of the FM tuner at normal input signal strength is better than 70dB, which is also quite reasonable. The FM tuner is likely to be frequently used, and as mentioned earlier a good external aerial is strongly recommended in low signal strength areas.

The AM tuner's frequency response is desultory to say the least, covering the range 45Hz to 2kHz within +0/-10dB. Whilst this is good enough for listening to the news, the bandwidth is simply not suffiicient for listening to serious music. (The argument frequently raised is that the music on the AM band is not good enough to listen to, but I for one do not support that view.)

I evaluated the distortion characteristics of the Music Centre using signals fed to the auxiliary input. The results confirmed that at he 4V nominal maximum output level, the distortion is very low. At the 0.1V input level, the distortion is still comparatively low at 100Hz and 1kHz, but is starting to rise at the 6.3kHz test frequency. The dominant fourth harmonic at that frequency is however well above the normal range of hearing.

The last objective test involved setting the unit up in my listening room and measuring the one third octave band 'pink' noise room response of the total system, with the AM5P MkII powered speakers connected.

The source material that I used to run the pink noise test is track 18 on the The Sheffield Test and Demonstration Disc, which provides five minutes of straight pink noise. (Five minutes is about five times longer and more convenient than the pink noise signal on anybody else's test disc...)

I soon discovered that the positioning of the sub-woofer (either vertical or on its back), and the positioning of the mid-range tweeter units has a dramatic impact on the perceived smoothness of the pink noise test signal. I adjusted the speaker positions by ear, and then measured the response with a 1/2" pressure response laboratory microphone with my real-time analyser.

The response I recorded was relatively smooth, and the top end in particular is very smooth all the way up to 16kHz. The crossover notch at 160Hz was clearly observable in each test. The base response is adjustable, with the output dependent on the orientation of the powered speaker loading ports. I preferred the response with the sub-woofer on its back, and with the ports pointing towards the far wall, whilst spaced at least 600mm from the wall.

The tweeter response and the bass unit response may also be adjusted to suit personal taste. This is achieved with two rotary contour controls on the powered speaker module. We found that when the treble control is advanced into the (+) range, it results in the mid-range/tweeter units displaying a strident characteristic, which was unpleasant.

The 202-page handbook has 41 pages devoted to English, and the rest devoted to four other languages. Fig.8 and 9 provide very basic instructions for the user on getting the best sound.

Whilst I found no problems with those instructions, I suggest that some others might, and I would strongly suggest that Bose adopts the philosophy of instructing its dealers to provide additional advice. Better still, it could provide a supplementary brochure with a CD test disc, explaining how to use a pink noise test track to optimise the smooth sounding characteristics of the system in the listening room.

MEASURED PERFORMANCE OF BOSE LIFESTYLE MUSIC CENTRE

Model No. LSM5 Serial No. E134755

DISTORTION (@1kHz) WITH SIGNAL TO AUXILIARY INPUT

Output Level

Volts	2nd	3rd	4th	5th	THD%
4.0	81.5	71.8	95.4	89.7	0.03
1.0	66.2	90.2	99.7	96.0	0.05
0.1	63.7	32.9	-	-	0.06

DISTORTION (@100Hz) WITH SIGNAL TO AUXILIARY INPUT

Output Level

Volts	2nd	3rd	4th	5th	THD%
4.0	82.5	74.0	116.8	91.2	0.02
1.0	66.1	97.2	118.1	98.0	0.05
0.1	73.2	99.1	-	-	0.06

DISTORTION (@6.3kHZ) WITH SIGNAL TO AUXILIARY INPUT

Output Level

Volts	2nd	3rd	4th	5th	THD%
4.0	92.7	68.9	75.4	-	0.04
1.0	67.4	75.4	65.7	-	0.07
0.1	62.2	69.8	44.5	-	0.60

DISTORTION (@1kHz) CD PLAYER INPUT

Input Level

dB	2nd	3rd	4th	5th	THD%
0	82.0	77.0	87.3	82.8	0.02
-10	81.	73.5	76.3	80.2	0.03
-40	57.2	69.6	65.2	66.7	0.16
-60	47.1	46.1	-	50.8	0.72
-70	39.7	25.0	39.2	40.8	5.9
-80	24.3	28.2	39.8	36.1	7.5
-90	14.2	20.8	19.2	8.6	44.3

Listening tests

Having completed my objective testing, I spent the next three weeks listening to the Lifestyle Music Centre. I used it in the way that you and I would want to use it, as the primary music system in our house.

I soon discovered that the remote control is an absolute joy and delight. I could turn on the music, go to bed and control the music system in my living room, whilst sitting up and reading in bed or lying down getting ready for sleep. Unlike my existing system, I didn't have to get out of bed and walk to the next room to turn it off. Even better, the Lifestyle Centre could be programmed to do it for me, using the AUTO/OFF function or the black OFF button.

I listened to the FM channels, and was impressed by the clarity of the reception. Then I listened to the AM, and quickly switched back to FM, as the difference in quality and clarity was simply too great. Most of all however, I listened to the CD player — and although it may not offer the best performance figures, when used for the purpose intended it is outstanding and extremely functional.

Apart from the test software on The Sheffield/Coustic Test and Demonstration Disc (Sheffield 10040-2), which convinced me that speaker placement is as critical as the perception of the listener, I also discovered that the tone controls on the powered speaker module should be left at centre position, or detuned by a suggested 1dB increment.

I repeatedly listened to two other discs, the first being 'Jessye Norman Sings Alban Berg' with Pierre Boulez conducting the London Symphony Orchestra (Sony Classical SK 66826). The Lifestyle Music Centre and AM5P speakers provided a respectable performance, and although not in the same class as my monitor speakers, the performance was nonetheless scintillating and outstanding.

The other new CD I used was of the 'Four Last Songs' by Richard Strauss, featuring renowned sopranos Edita Gruberova, Karita Mattila and Lucia Popp with Michael Tilson Thomas and the London Symphony Orchestra (Sony Classical SK 48242).

With the tweeters correctly orientated, the quality was equally good in almost every sitting or standing position I tried within the room. I subsequently listened to this disc in my bedroom, and realised just how convenient and attractive the Lifestyle Music Centre really is.

We received visitors whilst I was listening to the system on a number of occasions, and most were immediately impressed by the visual attributes of the system — particularly when they initially had difficulty in identifying the location of any of the system's components.

Summary

After three weeks of listening and many visits from family and friends, I am aware of at least two families who have now decided that the Bose Lifestyle Model 5 Music Centre is the greatest thing since 'sliced bread'. Both have assured me that they intend to purchase their own systems, as they are now suitably impressed by its performance.

Having now packed the Lifestyle Music Centre back into its box, I must acknowledge that I really will miss its outstanding and endearing features. I am convinced that the outstanding remote control potentially places it in the 'number one' position in the market place.

The Lifestyle LSM5 Music Centre itself measures 380 x 230 x 60mm, with a weight of 1.7kg. The amplifier/bass module of the companion Acoustimass AM5P powered speaker system measures 360 x 480 x 190mm, and weighs 16.8kg. The RRP for both, purchased as a complete system, is $3048.

Further information on both products is available from Bose Australia, 11 Muriel Avenue, Rydalmere 2116; phone (02) 684 1022, or fax (02) 684 1665. ❖

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FEATURES	91	92	96	99
50 MHz Bandwidth	1 Ch.	2Ch.	2 Ch.	2 Ch.
Continuous Autoset	•	•	•	•
Automatic Setups	•	•	•	•
Long Term Recording	•	•	•	•
DMM + Waveform	•	•	•	•
True RMS Volts	•	•	•	•
Continuous Beeper	•	•	•	•
10 ns/div to 60 s/div)	•	•	•	•
1 mV/div to 100V/div)	•	•	•	•
Digital Trigger Delay	•	•	•	•
RPM, Temp functions	•	•	•	•
Current Clamp Scaling	•	•	•	•
Scope Cursor Readings	-	-	•	•
Glitch Capture - 40 ns	•	•	•	•
Screen Memory	-	-	5	10
Waveform Memory	-	-	10	20
Set-up Memory	-	-	20	40
Waveform Math & Filter	-	-	-	•
Signal Generator	-	-	-	•
Component Tester Output	- Volts & Current			•
RS-232-C Interface	•	•	•	•
Printer Output	-	-	•	•
Backlit Display	•	•	•	•
Help Function	•	•	•	•

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Model 91: Flukes lowest priced ScopeMeter the 91 is a single input channel digital oscilloscope. The 91 features an analog-like backlit display, continuous autoset, a full-featured true rms multimeter with special modes, frequency counter, direct access measurement menu, Trendplot™, current clamp scaling, and on-line help messages. Screen transfers can be made to a PC (optional interface cable required). Sealed against the elements and protected by a shock resistant holster with battery or ac line power, the 91 works wherever you work.

Model 92: As the 91, plus a second channel.

Model 96: The 96 adds measurement cursors and memory functions – save screen images, capture waveforms, and enable front panel setups. Like the 92, screen transfers can be made to a PC. And screen readout(s) and waveform(s) can now be transferred directly to a printer.

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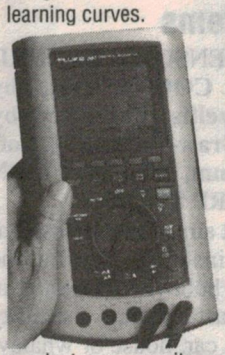
Fluke's 860 Series is a family of three GMM™ test tools that are the first high-accuracy, high-performance multimeters combined with analog, digital and graphical displays. They allow users to view information in the form best suited for their application. And for the first time, this graphical power is accessed through an easy-to-use, rotary switch familiar to many multimeter users. This virtually eliminates long learning curves.



860 Series GMM test tools offer the highest accuracy (0.025% dc) in a handheld meter. They feature 32,000-count (4 2/3 digit) resolution, a dual digital display that gives users extra information and an Analog NeedleGraph™ display. Meter mode enables users to directly measure Vac/dc, Aac/dc, ohms, conductance, capacitance, frequency, duty cycle, pulse width, period, and dB. The GMM test tools also offer a new AutoDiode™ feature (patent pending).

Waveform Display, with up to 1 MHz signal bandwidth, provides a clear picture of noise, waveform distortion, intermittent failures and glitches. The AutoGraph™ display setup automatically scales voltage, time-base, triggering and position for fast and easy test setups. Manual setup or external triggering are also available.

TrendGraph™ plots high resolution meter readings for up to 30 hours, in intervals from 1 second to 15 minutes, to detect such anomalies as power sags/surges and droops.

FEATURES	863	865	867
Basic dc accuracy	.04%	.04%	0.025%
30 mA dc accuracy	0.1%	0.05%	.05%
Current ranges	4	6	6
Frequency counter	2MHz	>10 MHz	>10 MHz
AC bandwidth (-1 dB)	300 kHz	300 kHz	300 kHz
Display bandwidth (typ)	1 MHz	1 MHz	1 MHz
Logic activity	-	•	•
Component test	-	•	•
LCD backlight	-	•	•
Internal battery charging	-	•	•
Waveform memory	-	•	•
Alkaline batteries	•	•	-
Battery eliminator	-	•	•
NiCad batteries	-	-	•
Optically Isolated RS-232 cable & adaptors			•
FlukeView 860 software	-	-	•

80 Series Analog/Digital Meters

Fluke's 80 Series 4000-count DMMs provide high performance measurement of dc/ac voltage and current, frequency, duty cycle, resistance, conductance and capacitance. All three meters are EMI shielded and come with a splash-proof and dust-proof case. A protective holster enables safe use under harsh operating conditions.

Taken as a family, the 83, 85 and 87 cover 40 ranges – from 400 mV to 1000V for dc/ac voltage and 400 µA to 10A for dc/ac current; 400Ω to 40 MΩ resistance; 40 nS for conductance; capacitance of 5 nF - 5 µF; and frequency from 99 Hz to 999.9 kHz.

FEATURES	83	85	87
Digital Display	4000	4000	4000 19,999 in high res. mode
Analog Readout Bargraph	43-segment Pointer	Analog	
AC/DC Voltage (400 mV to 1000V)	•	•	•
AC/DC Current (400 uA to 10A*, All Fused)	•	•	•
Resistance	•	•	•
Freq. & Duty Cycle	•	•	•
Capacitance	•	•	•
True-RMS Vac, Aac	-	-	•
1 ms Peak Hold	-	-	•
1000Vrms Input with Input Alert™	•	•	•
MIN/MAX Av. Recording Mode with MIN/MAX Alert™	•	•	•
TouchHold & Rel.	•	•	•
Splash & Dust Proof Holster w/Flex-Stand™	•	•	•
EMI Shielded	•	•	•
Backlit Display	-	-	•
UL 1244 Listed	•	•	•

** 10A continuous, 20A for up to 30 seconds*

Choosing the Right Meter for you

Accuracy of Vdc/ac and Adc/ac is greatest in the 85/87: 0.1% for Vdc, and 0.2% for Adc ; the 85 has greatest accuracy for Vac (0.5%) and Aac (0.6%).

Model 83: With a 4000 count display that updates 4 times per second, the 83 has dc accuracy of 0.3%. It also has a 43-segment, high resolution analog bargraph, TouchHold™, Relative, MIN/MAX Average Recording, MIN/MAX Alert™, and Zoom.

Model 85: As the 83, but increases Vdc accuracy to 0.1%.

Model 87: A true-rms ac meter with a 4 1/2-digit high resolution mode (19,999 counts), the 87 offers 1 ms Peak Min/Max Hold and a high resolution analog pointer. The 87 has a backlit display, enabling clear readings in poorly lit locations.

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NEW BOOKS

Switcher design

SIMPLIFIED DESIGN OF SWITCHING POWER SUPPLIES, by John D. Lenk. Published by Butterworth-Heinemann, 1995. Hard covers, 240 x 156mm, 224 pages. ISBN 0-7506-9507-2. RRP $79.00.

Well known US technical author John D. Lenk has been at it again, it seems. Back in the March issue, I reviewed his recent book *Simplified Design of Linear Power Supplies*; with the present title he has now provided a similar and semi-complementary work on switchers. Like the earlier volume it's one of a series sponsored by respected US magazine *EDN*, and as the title suggests it again takes an essentially 'practical' approach, with maths kept to a minimum. So again it's going to be of primary interest to students and technicians — although designers may also find it a handy reference.

There are five chapters in all, dealing respectively with switching supply basics, heatsinks, inductors and transformers, testing and troubleshooting, and finally simplified design strategies for the various configurations.

Not surprisingly, the book has a heavy emphasis on US components and suppliers. This isn't likely to present Australian readers with too many problems, as most of the components discussed should either be available here, or capable of being replaced by a substitute. The only problem in some cases may be to find the local distributor or dealer for the US manufacturers cited...

Those who are sufficiently interested in power supply design to buy both this and the 'Linear' title will discover that some of the material in the earlier book is used again here. For example the second chapter, on heatsinks, is almost identical; there's also a fair bit of common material in the chapter on testing an troubleshooting.

All in all, though, it provides a good deal of sound practical information on switch-mode supply design, and should therefore be of value to anyone wanting a primer on the subject.

The review copy came from Butterworth-Heinemann Australia, of PO Box 5577, Chatswood 2057. (J.R.)

Security systems

THE ALARM, SENSOR & SECURITY CIRCUIT COOKBOOK, by Thomas Petruzzellis. Published by Tab Books (McGraw-Hill), 1994. Soft cover, 187 x 235mm, 288 pages. ISBN 0-8306 4312 5. RRP $39.95.

This book is not aimed at professional security system installers, but at the experimenter and hobbyist interested in designing, or at least building, a security system for a boat, car, house or whatever. It describes a wide range of fairly simple circuits based on readily available parts, and also describes the various sensors that can be used in a security system. In fact, if you want to find information on sensors in general, this book will prove very useful.

There's a chapter on computer interfacing, and quite a lot of the book concentrates on complete alarm systems. Output devices that are described include sirens, strobe lights and phone dialers. Wireless alarm systems are also discussed. It assumes a basic knowledge of electronics. Most of the circuits are based on either op-amps or linear ICs, but none is particularly hi-tech.

The book is written in the active voice, and is very readable and informative with clearly drawn circuits.

The review copy came from McGraw-Hill Australia, of PO Box 239, Roseville 2069. It should be available from technical and larger bookshops. (P.P.)

Test gear basics

TEST EQUIPMENT, by Peter Phillips. Published by Thomas Nelson Australia, 1995. Soft covers, 255 x 177mm, 181 pages. ISBN 0-17-008917-7. RRP $14.95.

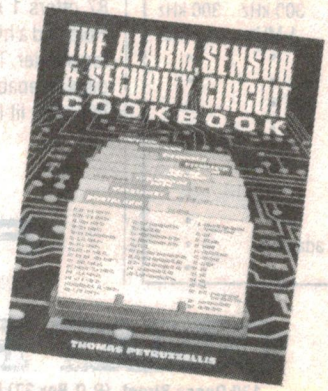
A further book by *EA*'s own Peter Phillips, and like his earlier books based on over 20 years' experience as a senior teacher at TAFE colleges — not to mention his many design projects, articles for *EA* and other magazines, and technical training work. Like his recent titles *Electrical Fundamentals* and *DC Principles*, this one was written primarily for use by TAFE students studying the national modules NE20 (Test Equipment) and NE105 (Advanced Test Equipment), but the material presented should make it of considerable value to almost anyone wanting a sound but accessible introduction to electronic test instruments and their use.

Of special interest is that for this volume Peter not only wrote the text, but also drew all of the diagrams himself using various CAD packages (primarily *Ami Pro*), and then laid out and 'desktop published' the complete book as well. I must say it's a credit to him, too — the diagrams are of a very high standard indeed, and the overall layout is particularly clean and 'friendly'.

There are eight chapters in all, covering respectively the analog multimeter, digital meters, circuit testers, measuring resistance, other meters, DC power and AC signal sources, the CRO and 'extra information'. The text only assumes a knowledge of electrical fundamentals and Ohm's law, and is easy to follow.

Overall, a very informative book on this important subject.

The review copy came from Thomas Nelson Australia, of 102 Dodds Street, South Melbourne 3205; however it should be available at most technical and college bookstores. (J.R.) ❖



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THE SEARCH FOR LIFE AMONG THE STARS

For the first half of this year, Australia's Parkes Radio Telescope has played an important role in Project Phoenix, the international project aimed at detecting possible signals from intelligent life elsewhere in the universe.

by GEOFF McNAMARA

The search for extraterrestrial intelligence (SETI) is as old as our interest in the stars themselves. Ever since people looked up at the night sky, they've wondered whether there's life up there as well as here on Earth. This year, scientists have been using the 64-metre radio telescope at Parkes, in the hope of answering the question: 'Are we alone?'

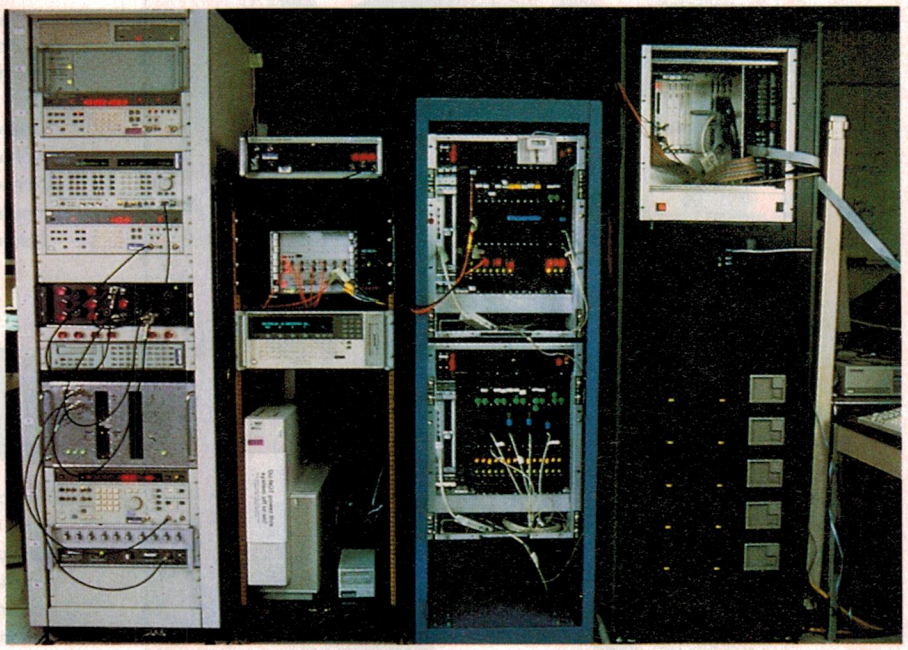
Using a receiver capable of examining 76 million channels simultaneously, SETI astronomers have been pointing the Parkes telescope at some of the nearest stars to the Earth. Their aim has been to detect radio signals from an alien civilisation.

Modern SETI began with the 1960 search called Project Ozma, whereby SETI astronomer Frank Drake pointed a 26-metre radio telescope at two nearby stars for two months. The results were inconclusive, but not negative. Until artificial signals are received from deep space, the question of extraterrestrial intelligence will remain open.

As Giuseppe Cocconi and Philip Morrison point out in their 1959 paper proposing SETI: "The probability of success is difficult to estimate, but if we never search, then the probability is zero." What Project Ozma did show, however, was that scientists are serious about finding other civilizations.

Since Project Ozma scientists and politicians have debated SETI on a number of fronts, ranging from whether or not life actually exists to what's the best way to detect radio signals coming from alien civilizations. After a long history of sporadic funding, the SETI Institute was established to coordinate NASA's SETI programme, and the US government supported the search with hard cash. The future for SETI looked bright.

The most recent of NASA's efforts was a 10-year search called the High Resolution Microwave Survey (HRMS). The HRMS involved two search modes: a systematic survey of the entire sky, and a 'targeted search' of 1000 nearby sun-like stars. The program was begun in 1992 on the 500th anniversary of Columbus's arrival in the New World. But faced with an enormous national debt, the US government found it difficult to justify a scientific project that was, to many people, little more than science fiction. Less than a year into the search, Congress withdrew funding. The HRMS was over.



The Project Phoenix Targeted Search System (TSS), which occupies about the same space as the equipment used in the original SETI, Project Ozma conducted by Frank Drake in 1960. It analyses 28 million channels.

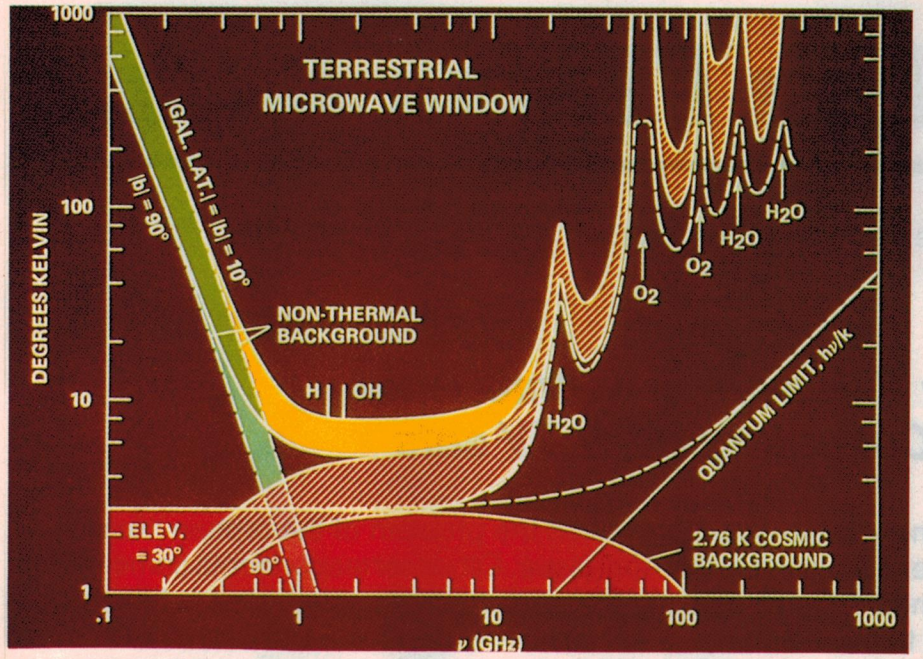
But SETI's supporters refused to let the search die. Through private donations and benefactors, the Targeted Search mode of the HRMS has been financed. The new search is appropriately called Project Phoenix.

The SETI Institute has been renting the Parkes Radio Telescope during the first half of 1995, to search for extraterrestrial transmissions. Between January and May, large blocks of observing time were handed over to SETI.

The telescope itself has been fitted with specialised receiving and decoding equipment. The receiver covers an incredible 200MHz bandwidth, operating between 1GHz and 3GHz. The receiver has a resolution of 1Hz, and covers wavelengths possibly not available to astronomers before.

While the SETI scientists have used up large amounts of observing time, astronomers were able to use the SETI equipment on whatever project they liked, when it was not being used in the search.

During the five-month search, Parkes has acted as the main receiver while a smaller radio telescope at Mopra in northern New South Wales acted as a verification unit. In the event of anything being detected, the astronomers



Project Phoenix involves a systematic survey of a 'quiet' portion of the electromagnetic spectrum — the 'window' between one and 10 gigahertz. In fact, the search concentrates on the one to three gigahertz range.

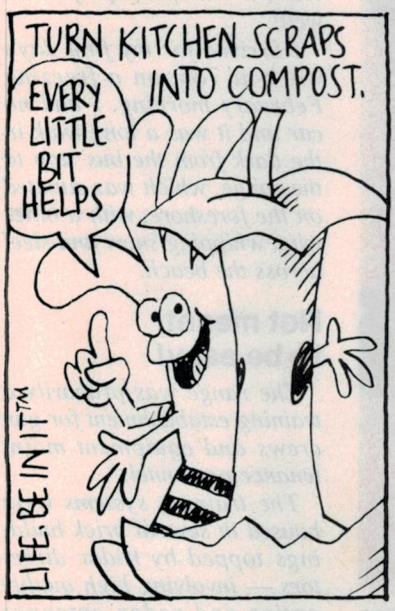
were to use the smaller telescope as an independent check on the signal.

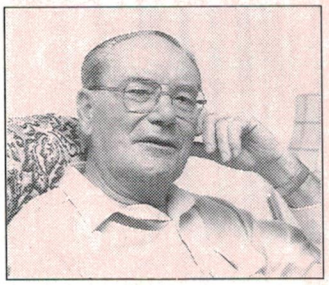
Just how earthlings will react if the SETI astronomers turn out to have found anything is difficult to judge. But at least there are *some* immediate returns, to keep the politicians happy.

Bobby Vaille from the University of Western Sydney points out the CSIRO-designed and built receivers have brought $2 million into the country. According to Vaille, the SETI Institute 'knew that the CSIRO group are the best in the world'. She adds that even if the search turns up nothing in a hundred years, such a negative result still has major implications for how we view ourselves and the planet we live on.

The Australian leg of the search was to continue until mid-1995, when the receivers were to be moved to the 300-metre Arecibo radio telescope in Puerto Rico for the remainder of the project.

(*Geoff McNamara also contributes to Sky & Space magazine*) ❖





When I Think Back...

by Neville Williams

Readers think back: Electronics maintenance has its drawbacks; Collecting B&W TV sets

A telephone call from a totally unexpected source resolved the problem of the orphan 'Kelvinator' black and white television receiver discussed in the April issue. Other correspondents came up with relevant circuit diagrams. This month I'm also taking the opportunity to acknowledge letters from other readers keen to contribute to this column...

Regrettably, these days, I cannot personally acknowledge each and every letter I receive, but will do my best to respond through the column.

First in the file is a technical tale written by John Rich, who contributed to our article in the last issue on A.C.E. Radio — the latter in the way of information and photos secured at a time when few other visitors would have realised that what they were looking at would one day become electronics history.

When John Rich first contacted us, he enclosed a 'technical tale' as an indication of his background and his interest in the history of radio technology.

As it wasn't directly relevant to an article on A.C.E. Radio, it was set aside. Looking at it again, however, I realised that it could be likened to some of Tom Moffat's free-wheeling observations, except that it was set a little further back in time and on the south coast of Britain, where exposure to Atlantic weather can complicate the maintenance side of electronic sensing and communication.

Granted, the above remark may prompt readers to claim that situations in other parts of the world can be no less daunting. Even so, I re-read with interest John's word picture of an 'ancient' radar installation dating back to World War II.

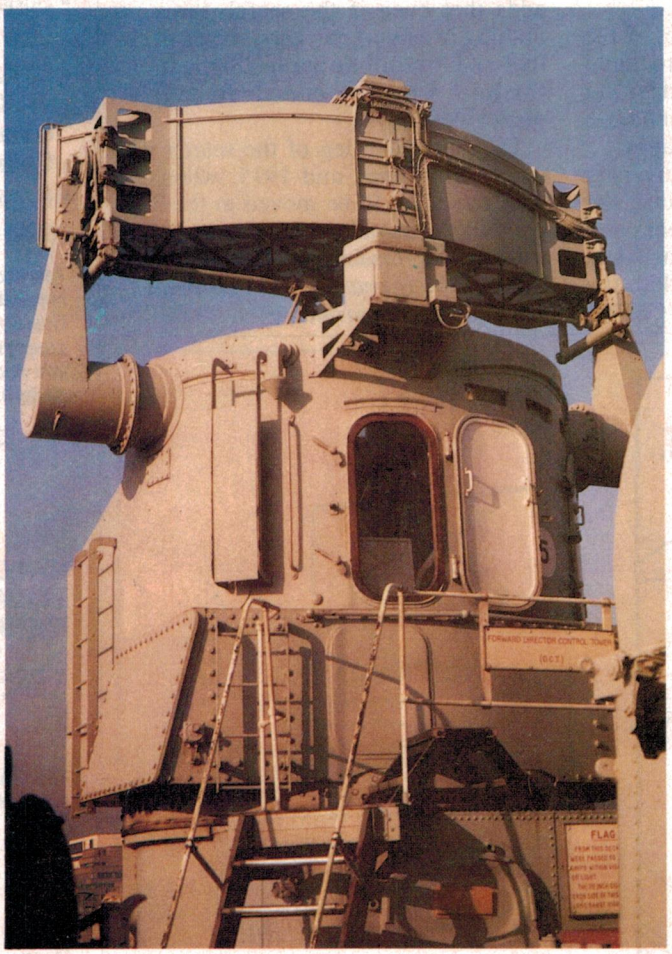


Fig.2: A rear view of the gunnery radar on the HMS Belfast. The curious arms supporting the radar beam originally supported an optical rangefinder.

Explains John (with editorial abbreviations to conserve space):

In February 1966 I returned to my home town on the SE coast of England from a brief stay at university, brushing up my maths. In so doing, I gained the chance to work on radar weapon systems at a nearby Royal Naval gunnery range.

Initially, I was interviewed by a Naval Officer who seemed to know little about radar, the person who should have interviewed me being absent. From my point of view, it was perhaps just as well!

I arrived for my first day's work at 7am on a freezing February morning. I had no car and it was a long walk in the dark from the bus stop to the range, which was situated on the foreshore, with a bitter wind whipping snow and sleet across the beach.

Not meant to be easy!

The range was primarily a training establishment for gun crews and equipment maintenance personnel.

The training systems were housed in several brick buildings topped by radar directors — involving high quality optics and radar antennas which could tilt and rotate to point at the target. The guns

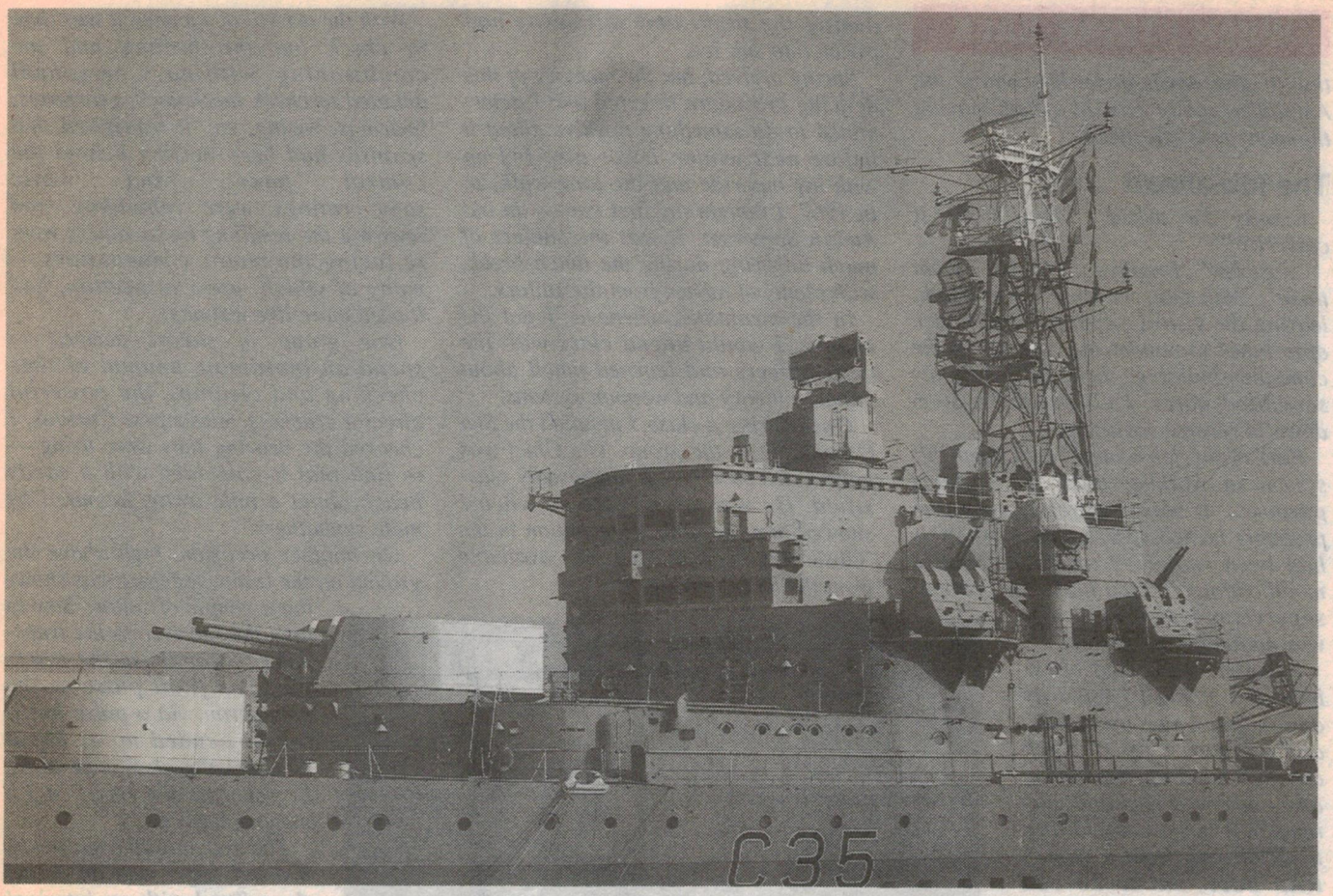


Fig.1: The old cruiser HMS Belfast, on the Thames. The forward gunnery radar, broadly similar to that discussed by John Rich is mounted atop the bridge and forward of the mast. Sailors in the cab acquired the target by optical sighting, while other crew members in the TS (Transmitting Station) below deck manned the radar.

and missile launchers controlled by the systems were ranged in front of the buildings, pointing out to sea.

After preliminary discussion with the Captain, I was shown the equipment on which I was to work. Most of it was modern guided missile gear, with which I was familiar. No problems thus far!

However, at the far end of the range, I was introduced to an ancient S-band gunnery radar, installed towards the end of the war, which would have made it about 20 years old. At its heart was a mechanical computer, characteristic of the era, the whole system being housed in a three-story structure identified as the 'computer building'.

The ground floor contained the transmitting station (TS) and maintenance facilities. Off to one side was a smaller building containing an assortment of motor-generator sets.

The second floor was mainly classrooms for gunnery training. Above these were a couple of penthouses containing spares and training aids. One of these was topped by a huge director, with which was associated the optics, the radar transmitter and receiver.

Out front of the building was a twin barrel 4.5-inch naval gun controlled by the system.

I will never forget being shown the TS that morning — a huge room full of screens and racks of equipment containing EF50's and octal valves. There were no windows, dim lighting and rather basic air conditioning — the idea being to simulate battle conditions.

Easy if you know how!

The Chief Petty Officer (CPO) led me to the centre of the room and said: "You know all about this stuff; I'll leave you to it". With that he walked out!

In fact, I had never seen it before in my life, but I couldn't admit to the fact without losing face. I was supposedly the 'expert' from the dockyard... and I didn't even know how to switch it on!

For the next couple of days I searched for manuals. There were plenty to do with maintenance, but nothing about operating procedure. However, I did learn that the previous maintenance man had retired some months earlier, and that the CPO had been switching it on ever since. That offered me a possible way out of my dilemma.

Would he show me the order in which he had been switching on the equipment, before I arrived?

Why, something wrong?

Nothing, really — just a couple of minor inconsistencies!

Sure, he'd be glad to help...

I grabbed a notebook and we headed for the Computer Building. The first surprise came when he turned into the shed which held the rotating machinery — motor generators and frequency converters. One big unit supplied 220V DC for the systems motors; others supplied 33Hz for the gyros, 400Hz for the radar, 60Hz for the American control system, and so on.

Suddenly it hit me why there had been no 'power available' indicators on in the TS. This time, when we headed there, the place was aglow and alive with the gentle buzz of transformers, etc. To this was added the song of gyros and fans as he switched things on — and as I diligently scribbled notes!

We then climbed onto the roof, where he demonstrated the gun director in ac-

tion. It spun easily under his control, the Amplidyne motor control system moving the many tons effortlessly.

The job ahead

Finally he asked: ' 'Did I do it correctly?"

"Just fine", I replied, "I'll take it from there". With that, we went off to lunch, leaving the system running. I came back after lunch to ponder the contents of the computer building; then, guided by my scribbled notes, I closed the system down in reverse sequence.

Part of my job would be to keep this system in working order for training purposes. It was manifestly very old, probably lacked spares, and most likely had been subjected to undocumented modifications. To cap it all, the previous supervisor had retired and was no longer accessible.

I figured that I had better initiate a planned familiarity and maintenance procedure, and see how I fared. Each day, I started up the system and noted voltages and currents in a book. I would then track aircraft from a nearby RAF base, out to 20-odd miles until the blip disappeared into the noise and the system began to lose lock.

Considering its age and condition, it was surprising how well the old system performed, the precision mechanical computer and rate gyros compensating well for the somewhaterratictransmitter.

The transmitter used a crude spark gap modulator, rendered all the more temperamental by the damp, salt air. This type of modulator, I gathered, could have been replaced by more reliable gas thyratrons, but the trainees had to become familiar with the older system.

It was February; very cold, with snow. Some mornings the system was required early, so when I arrived at 7am, I would turn everything on to warm things up.

If the director was covered with snow, I turned on the blowers and heaters. But if they didn't work, I would have to climb up on top in the freezing darkness and scrape off as much as I could. I would then direct a fire hose on it to remove the rest.

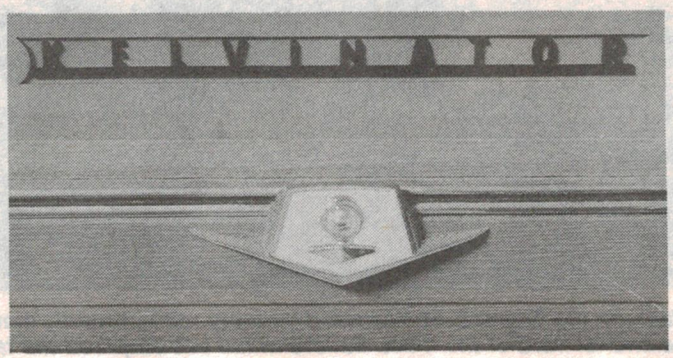
The best of it

This procedure worked but it was an awful job — particularly if sea spray had been breaking over the building during the night and salt spray had frozen into salt ice.

Spring arrived, but the memory of this de-icing procedure lingered and I determined to do something positive about it before next winter. I was also fed up with my bus ride and the long walk, so in 1967, I bought my first car — an old Austin Somerset. It was the subject of much tinkering during the lunch break, with plenty of advice from the sailors.

In the meantime, whenever I got the chance, I would attend class with the petty officers and learned much about gunnery theory and weapon systems.

Once during a class, I detailed the Sea Cat missile to the group. The Chief was uneasy, because it was supposedly classified. He was even more so when I showed him the same information in the 'Observers Book of Missiles', available from the local newsagent!



What all the fuss has been about: a 'Kelvinator' logo on a 1950's style 21 inch B&W TV receiver. Kelvinator (Aust) seem to have forgotten they existed, but in fact they were rebadged models manufactured by HMV/EMI.

Being a civilian, young sailors who were dissatisfied with the Navy would often approach me for advice when it came time to re-enlist.

I figured that they had a better life than they realised, and my routine answer was to suggest that they check through the local paper for suitable civvy jobs before making up their mind. They usually saw the point.

The range, like most naval establishments, hosted its share of semi-wild cats. At the outset, I enjoyed watching mother cats tending their kittens in the warm spring sunshine. I became less tolerant when the fire alarm was triggered by feline piddle, on/in the EHT system. Or when the place stank for a fortnight, until we located a feline corpse deep inside the complex of air conditioning ducts.

Nor were the pussies consistently friendly, as another maintenance man discovered when one attacked his groping hand!

With the arrival of summer, it was time to check out the heating and air conditioning, with navy personnel detailed to check mechanics, gearboxes, bearings, wiring, etc. It transpired that seabirds had been nesting behind the control panel, and while some ratings were rebuilding and rewiring the resulting mess, others were re-facing the motor commutators — many of which, upon inspection, had looked more like walnuts.

One group of sailors seemed to spend an inordinate amount of time checking and cleaning the powerful director tracking telescopes. Curious, I checked the bearing they were using — to find that it coincided with a sandy beach about a mile away, favoured by nude sunbathers!

On another occasion, high above the ground on the radar system, I was showing a couple of sailors how to tune the receiver to the transmitter to optimise the tracking. The final pulse to the magnetron, via a pulse transformer, ended up at about 37,000 volts at 40-odd amps, to generate the required 1.5 megawatt peak.

The system was enclosed by a metal cage, with an access door fitted with an interlock to cut the power immediately it was opened. When I attempted to demonstrate as much to the sailors, the singing sound of the pulse transformer persisted. On checking, I found that the interlock had been bypassed by a long loop of wire.

I considered myself lucky to be alive. If the shock had not killed me, a fall to the ground from that height might have had a similar result!

Safety first?

Alerted, I checked all the other interlocks and found that many of them had been bypassed — presumably by my predecessors, to expedite servicing.

I chose to take an opposite view of personnel safety a few months later, when I noticed that tradesmen were ignoring my advice to avoid exposure to the radar beam when the power indicator was on. They had neither seen nor felt any effect and had obviously decided I had been 'having them on'.

At the next opportunity, I made it my business to join them, neon tube in hand. When the indicator light went on I held it in the invisible radar beam and it lit

up — with no wires attached. They got the message!

My stint at the range ended in August 1967, when I got the chance to move the London. But one Christmas, a few years back, I found myself in the UK on holidays and able to visit the old site. Yes, it was a grey afternoon with a chilly wind and light snow, and the memories came flooding back.

But the old system was gone, replaced by modern high tech magic. The guns were still there.

Back in London, I visited the cruiser HMS Belfast, on the Thames. It carried an old gunnery radar, similar to the one I had worked on. Down below was the TS with the fire control table — all of it forming part of a museum.

Nowdays I sit in an air conditioned office — with sealed windows — designing computer gadgetry you can hardly see, and recall the times, long ago, when I earned ten quid a week, plus overtime, for clearing snow and ice and filling a small role in naval radar history — but I'm glad I did it!

Thanks, John, for sharing your experience with us. Now for a complete change of subject matter.

Kelvinator TV set

In the April issue, prompted by Alan Barrow of Aspendale in Victoria, I raised the question of whether B&W (black & white) TV sets could logically be regarded as 'collectable' by electronics history buffs. Alan had been offered a well preserved, 30+ year old Australian-made Kelvinator model, but was puzzled because a spokesman for Kelvinator, a few weeks back, had denied that the company had ever been involved in television!

In the circumstances, I could only suggest that the set had been manufactured for Kelvinator by another company, and hope that one or other of our readers might be able to nominate the supplier and even come up with an appropriate circuit. Considering the lapse of time, it seemed a rather long shot.

Imagine my surprise when I received a phone call from a long-time friend, before I had even sighted the April issue, identifying the set and claiming it as 'one of his babies' when he was engineer in charge of TV set production at EMI's Homebush (Sydney) factory. His name: Neville Thiele — the same Neville Thiele who later resolved the problems surrounding vented loudspeaker enclosures.

Even though Neville lives only a couple of kilometres from my home, his copy of the April issue had arrived in the post a day ahead of mine and on recognising his 'baby' on page 36, he simply reached for the phone. He followed up with a letter the next day, after consulting his lab notes.

Neville recalled that EMI (Australia)'s first B&W TV had conformed to a 'gentleman's agreement' within the local radio industry, to launch into TV using a 17-inch 70° picture tube. In EMI's case, far from being conservative, it meant 'sticking their neck out' because, in the mid 1950's, their parent company in the UK regarded 14-inch picture tubes as the appropriate choice for domestic TV sets.

In short, the first TV chassis from EMI (Aust), released in August 1956 in time for the Olympic Games, used a 17-inch picture tube. Identified as the 'E' series, it was not the receiver pictured in the April issue.

Kelvinator became involved because they wanted to market TV receivers, but lacked the facility to manufacture them. Conversely, EMI faced the same problem with refrigerators. So the two companies reached an agreement: Kelvinator would supply EMI with suitably branded refrigerators; EMI, in turn, would supply TV receivers carrying the Kelvinator logo and the prefix 'K' added to the chassis number.

(I refer to 'EMI' in the above, because that is how Neville Thiele speaks of the company that paid his salary. To the trade and the public at large, they were more commonly referred to as HMV — His Master's Voice — distributors of radio & TV sets, sundry record labels and an implied associate of RCA, in the joint use of the 'Little Dog' logo.)

The 21-inch TV era

The first EMI/HMV 21-inch model was released about June 1957, which conflicts with Alan Barrow's assumption that the original owner had bought the set in question to watch the Olympic Games. By the time EMI/HMV 21-inch models appeared on the market, the games would have been history.

Neville Thiele recalls that EMI sought a quality image for their 21-inch, or 'F-series' TV chasses. I still recall the emphasis he/they placed on the phase linearity of the IF channel, in the interest of picture quality. What I had forgotten — or hadn't known — was that their 21-inch cabinets were also lined with aluminium foil, to restrict radiation into nearby radio receivers of the 15,625Hz sawtooth horizontal deflection signal.

For the same reason, they used a specially wound power transformer, to limit penetration of the horizontal sawtooth

into the power mains. I quote Neville here: "We were trying to be environmentally responsible!"

Neville Thiele said that, in planning the receiver, they realised that they could provide a push-pull audio system for little more than the price of an extra valve, thereby virtually doubling the available output power to six watts. They could also enhance the audio performance by fitting twin 7x5-inch elliptical loudspeakers, one on each side of the cabinet.

The one hassle they had with the circuit was that the total HT current drain added up to 360mA, equal to the maximum rated current of twin 6N3 half-wave rectifier diodes — the only option available in the Philips range, to which EMI were committed. That the valves didn't like it was evident from their sometimes limited service life — this despite the fact that the circuit included thermistors to limit peak warm-up current.

Fortunately, Bill Brear, EMI's Chief Design Engineer, managed to negotiate heavy duty full-wave 5AS4 Radiotrons from AWV, for sixpence each under the Philips price. So in the later models, F2 to F5, two 5AS4's operating in parallel handled the load easily, each with its own 5V filament winding and its own peak limiting thermistor.

Remote control

One other point of note was a socket at the rear for a remote control. With little in common with modern infra-red remotes, its main functions were to quieten the sound during advertisements and to adjust the black level, which was subject to variation in transmissions and receivers of the day.

EMI technical staff made up their own remote controls, but the Sales Department flatly refused to list the device as an available extra until 1960, when they were casting around for another feature to advertise...

Neville said that the basic design of the F1 chassis was repeated in the F3, F4 and F5 models which, gratifyingly, found their way into television stations as off-air monitors and even for re-broadcasting links for country transmitters.

He says that, from what he can determine from the picture in the April issue, Alan Barrow's receiver is an F2 consolette, missing from the above list. The F2, developed for release in 1958, had a simplified but still effective IF channel and a single-ended audio system. Its targeted retail price was 209 guineas, as compared to 245 guineas for the 'upmarket' equivalent.

Fig.4: From an advertisement in a Sydney suburban paper ('Northern District Times') in November 1957, the HMV and Kelvinator sets looked almost identical.

(The 'guinea', a distortion of the Imperial monetary system and beloved by lawyers, medicos, dentists and other professionals, was equivalent to 21 shillings. It camouflaged the charge, as expressed in pounds, but in so doing added an effective 5% surcharge...)

Other correspondents

If Neville Thiele's response was immediate, it didn't take long for other readers to react to Alan Barrow's letter. From Springwood in Queensland, Ray Dixon VK4ZLX says that he commenced work at HMV, Homebush, in 1954 and worked in the industry for 25 years before retiring due to ill health. He has been a long term, regular reader of *EA*.

Ray remembers the HMV factory as a place where they produced a wide range of components, including transformers, coils, chasses, metalwork, plating and elliptical loudspeakers as fitted to Alan Barrow's receiver. HMV later became EMI (Aust). He describes the arrangement between HMV and Kelvinator as follows:

In the early 50's the companies supplied each other with their respective badges, on a business agreement that a percentage of Kelvinator whitegoods be identified with an 'His Master's Voice' badge. Likewise, batches of HMV radio and television sets would sport the 'Kelvinator' logo. Apart from the badges, the equipment was identical in every way.

Ray Dixon suggests that Ray Barrow's receiver could be an HMV F1 chassis. Whether it is, rather than Neville Thiele's F2, could be deduced from whether it employs a single 6BM8 output valve or two in push-pull. Thanks for your letter, Ray!

Whereas Ray Dixon apologises for his inability to supply a circuit, the gap is filled by a letter from Reg Davis, of R.J. Davis Electronic Services in Yarra Glen, Victoria. Enclosed with the letter is a circuit photostat of an HMV chassis type F1, for which I also express my appreciation.

Without seeking to digest the circuit in detail, it did cause me to re-think my somewhat casual observation on page 37 of the April issue, about an enthusiast/collector needing to work out the how and why of B&W TV receiver circuitry. For sure, vintage B&W receivers have more in common with vintage radios than do modern colour sets, but there's still a heck of a lot of extra circuitry to digest!

As expected, the F1 circuit quite clearly shows twin 6N3 rectifiers and twin 6BM8 audio output valves.

Similar data on the F1 through F5 HMV/Kelvinator models is to hand from Les Whittle of Oxley, in Queensland; this time as a fax to the *EA* office. The diagrams are acknowledged to the *JR Manual* for 1967, and include the circuit of the tuner and remote control. Again, thanks Les.

'Very reliable set'

From Alan Birmingham, Service Manager of Unit TV Pty Ltd in Baulkham Hills NSW, comes a brief

note identifying the set as an F2 and enclosing a circuit diagram. It shows twin 5AS4 rectifiers, both wired as full-wave rectifiers with separate 5V heater windings and each feeding the HT filter through separate thermistors. In the event of one rectifier failing, the other would probably battle on for a while...

Alan describes the set as 'very reliable in its day, and one of the first to do without a front panel horizontal hold control, because of its remarkable pull-in range'.

Another fax arrived via Melbourne Airport, from Phil — (name obscured). Phil has opted for the F4 circuit, again showing push-pull 6BM8 output valves and twin 5AS4 rectifiers.

Last but not least, at the time of writing, I'll acknowledge letters from other helpful readers.

D.E. Liddicoat (VK5ADC) confirms that Alan Barrow's receiver is an HMV/EMI product, and then deviates to talk about public address amplifiers and the use of 32-volt soldering irons in the National Radio Factory in Adelaide.

Back to NSW, J.E. (Peter) Hughes of Hughes TV & Antenna Service in Vincentia mentions the arrangement between Kelvinator and HMV.

He adds that AWA had a similar arrangement with the Email (Westinghouse) Group, under which it supplied 'Airzone' badged TV receivers. As well, STC supplied the BGE brand.

On the general subject of collectability, he believes that B&W receivers will become rare quite rapidly and may be difficult to restore, due to a shortage of valves and especially picture tubes. Thank you, Peter.

And thanks also to Athol J. Manning (VK7LR), Eric G.Vidler of Birrong NSW and W.R. Beveridge of Berowra Qld; also to John Carr of Weetangwerra ACT, and Des Mills of Kurri Kurri NSW, whose letters landed on my table just as I was completing this article.

A happy ending!

Finally, there is an odd twist to this story. In thanking Neville Thiele for his first-hand background information, I mentioned that Alan Barrow's picture could as easily have been mistaken for a 17-inch screen, with its markedly rounded corners. That obviously stirred another memory, relating to a later period when the 90° 'F' series were to be superseded by G-series chasses using the new 110° picture tubes.

From first principles, Neville knew that a TV picture should be rectangular, with a 4:3 aspect ratio. He had accordingly designed a new mask that would fulfill those requirements — but the sales section wouldn't have a bar of it. Their view was that viewers were very conscious of picture size and that HMV could not afford to offer what might look like a marginally smaller picture, no matter how valid the technical arguments in its favour.

I gather that the confrontation climaxed an element of dissent between the Sales Department and technical purists in the lab. EMI Management's answer was to appoint another engineer to head up the team responsible for the new series.

Neville Thiele was accordingly 'promoted sideways', to the position of engineer in charge of the Company's research — much to his delight. He had paid his dues to TV receiver technology and said he, with a chuckle: "The move made it possible for me to pursue my research into loudspeaker enclosure technology".

I, for one, am happy that we could sort out Alan Barrow's B&W TV problem. But I'm positively delighted that EMI management unwittingly made it possible for Neville Thiele to replace the guesswork and empirical guidelines on loudspeaker enclosures, with rigorous data. ❖

AND NOW, LIVE FROM CHINA - 1

Radio and television outside broadcasts now routinely come from the four corners of the world, thanks to satellite technology. But have you ever wondered what it takes to produce one of these shows? Bryce Templeton takes us behind the scenes during a historic broadcast from China.

by BRYCE TEMPLETON

"We would like you to do an OB (outside broadcast) for an associated company", they said. "You'd be away from home for a while — it's in China."

That was how I became involved in the most long distance OB of my career.

The problem was that in 1987, the NBC network from the US had organised a week of the 'Today' early morning show, and the Evening News, to be broadcast live from China. The concept was to celebrate the 'opening up' of China to the west, a concept greatly in vogue at this time, but which did come a bit of a cropper a few years later.

This would be the first time any western company had been allowed to broadcast live and uncensored from China. Much negotiation and planning had taken place over many months, and the broadcast was now 'set in cement' as our American cousins are wont to say.

Unfortunately, or fortunately, depending on which side of the Pacific you were on, a long standing industrial dispute between the American radio and TV stations and the unions representing the technicians and operators suddenly erupted into a full-blown strike. A great fear settled in the hearts of the NBC executives, as they saw months of planning and hundreds of thousands of dollars rapidly receding over the horizon.

But wait! A year so earlier, the Today show had been done live from Australia. The Americans were greatly impressed with the skill, and especially the versatility, of the Australian crew they had used then, and they began to contact Australian TV executives at the Australian Television Network to see if an emergency crew could be assembled. So here I was, making an instant decision on going to China.

Rapid negotiations resulted in a team of two maintenance techs, one RF tech, a technical director, an audio director and a news cameraman from Sydney, and two techs from Brisbane appearing at the airport, in a state of great confusion. Because of the speed of the appointments, we really did not know what we were getting into, or even where we were going; we just did as we were told and got on a plane with 'Beijing' written on the front. (Actually it had Tokyo, as we had to change there and go on to Beijing via C.A.C. airlines)

Assembling one of the microwave link dishes, with the assistance of one of our ever smiling Chinese helpers (left). There was no shortage of equipment; quite the opposite, in fact. (Photo courtesy Greg Evans.)

Rigours of travel

We had a pleasant surprise on checking in, as we discovered that we were travelling first class. It appears that the Americans have a policy of first class travel for any destination more than eight hours away, which from Australia is just about anywhere.

We settled in nicely to the rigours of first class travel, beginning with the club lounge and continuing with the luxurious seats and gourmet meals.

After a wait of about two hours for our connecting flight in Tokyo, we arrived in Beijing mid-afternoon and, much to our relief, we were greeted by a member of the NBC management team. After Customs formalities, we found ourselves installed into a Hi-Ace van and on our way to the Sheraton Great Wall hotel in Beijing.

A short time into the trip one of the team was heard to ask, with as casual air as possible, about graphic signs displayed about every 500 metres along the road showing two cars colliding head on. It was, as we suspected, to indicate an accident black spot. Unfortunately this seemed to have no effect on our driver's style, which could be best described as 'avant garde'.

We discovered that the Great Wall hotel was very up-market, and was where the NBC management was staying. We were actually staying in the equally comfortable Chinese owned Kun Lun hotel, a block or so away.

After checking in, we attended a meeting at the Great Wall hotel and we found ourselves surrounded by a team of about 50 from the four corners of the world. There were technicians from England, Germany and Canada, as well as ourselves from Australia. Some of us — in-

cluding me — began to suspect that the roundup had been far reaching but not too thorough, in that our hosts seemed unsure of our particular talents, and had lots of maintenance technicians and a shortage of production people.

The next day we went on a tour of the production facilities and the Beijing broadcasting sites, Tian-an-men square (later to become famous around the world), inside the Forbidden City, and on top of the Great Wall of China. The latter impressed us much more than the production facility, which was an ancient and previously pensioned-off American OB truck that had virtually no equipment in it, and no wiring diagrams or other literature. It was parked in a large fenced yard, and a tarpaulin had been erected to keep the rain and sun off us as we brought about the miracle of the resurrection of the OB truck.

Our employers told us that, in the weeks leading up to the one week of live broadcasts, we were going to restore it to its former glory. And to prove it, they showed us a warehouse full of examples of every known piece of television broadcasting equipment ever invented, mostly brand new. There was more stuff here than we had in our whole station, at home...

So, it was simply a matter of deciding what we were doing and building a truck to do it. There was, they said, another truck of equal quality in Shanghai, from where the second half of the week's transmission was scheduled to originate.

Home-made truck

And so it came to pass. Over the next four or five days we each plied our respective crafts, making cables, sorting out the mountain of equipment in the warehouse, checking and adjusting monitors. The vision switcher and the audio mixer, about the only things that came with the truck that were any good, were tweaked and repaired, the videotape recorders installed. In short, everything that is required to convert a junk heap to a OB van. The pace was far from hectic, and NBC, always the perfect hosts, gave us the use of a mini bus and a translator/guide so that we could see all the tourist sights around the city.

After a couple of days we had settled down and divided ourselves into the groups that are universal in the TV industry. These are Production, Engineering, Operations (the planning for the best use of the production facilities), and Office/Management.

One evening the Engineering Director invited the engineering and production teams along to a restaurant for dinner. Naturally, it was a Chinese restaurant, and we were treated to a delicious meal — not always sure what we were eating, mind you, but sure that it was very good.

As the evening wore on, it was decided that we should have some of the local fire water called Mao Tai, just to finish things off. This was duly presented, in a white bottle which I now suspect was made of Kryptonite (the only known material that can contain this substance), and we each were given a liqueur glass full and warned to swig it straight down. I did this and considered it adequate, but my associate Greg really took to it and requested refill after refill.

Eventually he seemed to become suddenly tired, and had to sit down. His recovery powers however proved up to the formidable task he had set them, and he was as good as new in the morning.

So taken was he of this lightly distilled kerosene, that a few weeks later we spent many hours touring the bottle shops of Shanghai looking for some to bring back with us. The procedure was to go into the shop and say "MAO TAI" at ever increasing volume, until the proprietor, shaking his head to indicate a world shortage of that particular product, produced the equivalent diesel or petrol flavoured varieties. But Greg was brand loyal, and we persisted until we found the last remaining bottle in China, which was duly conveyed to these shores.

Touring Beijing

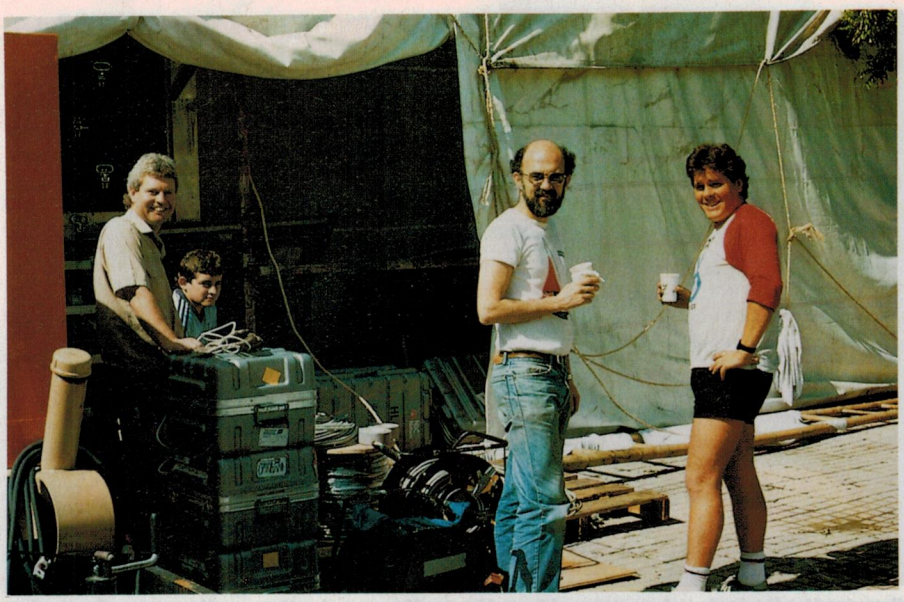
During these days we continued to busy ourselves by making miles of cables, both audio multicores and video, and installing some of the treasure house of equipment into the truck. The great plan was slowly becoming more clear, and it was also becoming clear that when my duties as an installation technician were finished, that I would be pressed into service as an audio assistant, and in that job that my training was sorely lacking.

Meanwhile our fellow 'Ossies' (as the Americans called us) Andre the cameraman and Bob the lighting director and his 'boys' were ranging far and wide thoughout Beijing, getting 'colourful insert material' for use during the broadcast.

One afternoon we took advantage of the guide and bus offer and organised a trip to a local ancient temple. On the way back, we decided to get dinner at a restaurant and asked the young lady guide for a recommendation. She directed us to a place and we waited in the bus while she went in and made arrangements. We subsequently went in and had, if not the best meal of the trip, at least passable fare. We were a bit surprised though, that she did not dine with us but instead disappeared with the bus driver.

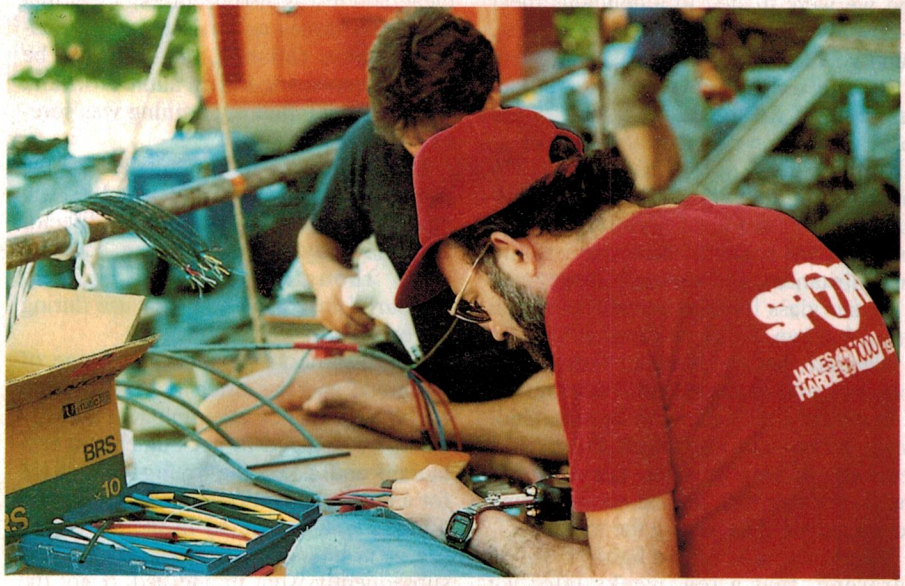
After we had finished they reappeared, and there was frenzied and loud negotiations with the proprietor about the bill. Eventually a figure was settled on which seemed to us to be very high, but as we were in no position to bargain, we paid it. We did mention the incident to the NBC people the next day, however, and were surprised to see how seriously the Chinese officials viewed it. We never saw the girl again.

Another side trip during these halcyon days was to the Beijing Zoo, to see the pandas. We could see the poor old panda asleep in his shelter, and happened to



A coffee break for part of the Australian crew, with the author second from the right. Behind the tarpaulin is the Beijing OB van. (Photo courtesy Greg Evans.)

Live from China



The author making up some of the hundreds of metres of audio cables required for the broadcasts. (Photo courtesy Greg Evans.)

mention that it was a pity that he wasn't strolling about his somewhat depressing enclosure. No sooner said than done! The guide spoke to a zoo official and next thing there is a man in the cage poking the poor panda with a bamboo stick, to encourage him to go for a walk — which he did, grudgingly.

Sprung

Back in the compound we continued with the preparations, and in our spare hours continued to visit the local sights. The evenings were usually spent in the sumptuous bars and many restaurants in the Kun Lun hotel.

This hotel was brand new, to the point of not actually being finished. One day we discovered that the smog that normally thickly blanketed Beijing in the summer had been blown away, and we decided to go on a photo expedition to the roof.

As with practically every new hotel in Beijing, this one was designed with a revolving restaurant on the topmost floor, but it and the three floors below it were a mass of builder's rubble and scaffolding. Naturally the lifts would not go to these floors, so we poked around in stair wells until we found a promising one and started up. As we ascended, we found that there was more rubble and less light the higher we got, but with great persistence we made it to the roof and were rewarded with excellent views to the mountains and the Great Wall.

Having taken our snaps, we then started down again; but as a side trip, we decided to explore the revolving restaurant — which, had it not been for the layer of broken tiles and bricks on the floor would be considered finished. All the cooking appliances were in, along with counters and fittings...

As we were discussing the quality of the finish, etc. we were surprised to see a couple of police/soldiers appear and indicate quite firmly that we should go downstairs. Which we did, this time in the lifts. Nothing more was said of the incident, but we were puzzled as to how they knew we were there. I suppose that buried somewhere in the rubble are TV cameras or intruder detectors.

The foyer of the Kun Lun is a magnificent structure of soaring glass wall and roof panels. It had a rain forest and an ornamental pool, with the various bars on small islands in this pool, connected by walkways of stepping stones. We viewed this architecture as a kind of Chinese breathalyser — if you can make it to the front door with dry feet, you can definitely drive home.

One evening as we were recovering from an arduous day, one of the Chinese waiters who, in our opinion, was getting a little over confident, slipped off the stepping stones and fell into the pool complete with a tray of drinks. An enormous roar and round of applause from the Australians and Americans greeted his dripping emergence, and he slunk off leaving the remains of the drinks in the pool.

Later we learnt that such incidents are viewed with great embarrassment in the Chinese culture, and that the correct response would have been polite silence. Such is the result of a clash of cultures. A glass remained in the pool for the remainder of our stay.

Chinese rip-off

The Chinese did get back at me however, when we visited the Ming Tombs — the burial place of 13 Emperors of the Ming Dynasty, dating back to the fifteenth century. When we boarded our bus to go home, it was instantly surrounded by people selling all manner of souvenirs.

A book was pushed though the window for me to sample, and as it had many nice colour photos and English

Continued on page 62

It wasn't all work, of course. Here the author and other colleagues from the Australian crew are seen visiting the Beijing Zoo. (Photo courtesy Greg Evans.)

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Keyboard ext. lead 3m	(5pin DIN P to S)	$11.95
Keyboard ext. lead 5m	(5pin DIN P to S)	$13.95
Keyboard lead 1.8m	(5pin DIN P toP)	$9.95
Joystick ext. lead 1.8m	(DB15 P to S)	$9.95
Ethernet lead 1.8m	(BNC P to P)	$7.95
Ethernet lead 3m	(BNC P to P)	$9.95
Ethernet lead 5m	(BNC P to P)	$14.95
Ethernet lead 10m	(BNC P to P)	$17.50
RJ45 patch lead 1m		$8.50
RJ45 patch lead 2m		$10.00
RJ45 patch lead 3m		$12.00
RJ45 patch lead 4m		$14.00
RJ45 patch lead 5m		$16.00
External SCSI cable 1m	(Centronics P to P)	$16.95
External SCSI cable 2m	(Centronics P to P)	$19.50
Ext. SCSI-II cable 1m	(Micro DB to Cent.)	$59.00
Ext. SCSI-II cable 1m	(Micro Cent. to Cent.)	$59.00

PCMCIA: PRETTY PUNY PERIPHERALS

No doubt you've noticed those tiny credit-card sized memory cards, modems and other peripherals now used by laptop computers. But do you know how they actually work, and what they allow you to do? Here's an easy-to-follow explanation, written in Tom Moffat's usual friendly style...

by TOM MOFFAT

PCMCIA: what a mouthful of acronym! PCM — Pulse Code Modulation perhaps? And CIA — well, we all know *that* means Central Intelligence Agency. Sorry, wrong on both counts; the correct answer is — all together now — 'Personal Computer Memory Card International Association'.

The name might sound like a load of bureaucratic twaddle, but it refers to one of the most important things to come onto the computer scene in the past 10 years: little plug-in cards that make ANY peripheral device work with ANY computer. Well, almost; that's the idea, anyhow. PCMCIA cards are set to replace all those big circuit boards that plug into slots within computers like the IBM-PC.

If you look inside a current desktop computer, you're likely to find one plug-in card which is a modem. Another may be a LAN (Local Area Network) interface; yet another may contain extra memory. There may be a card controlling the hard disk, another controlling a CD-ROM drive, and another for sound generation.

Each of these cards will have a collection of DIP switches which must be set to tell the computer which memory addresses the card intends to use, and which interrupts it will take control of. The user must figure all this out, and ensure that two cards don't try to use the same memory or interrupts. If this happens the most spectacular result is a complete crash. Or the effect might just be some niggling little bug, that takes months to track down.

With the advent of laptop, and then notebook computers, there were no slots; nowhere to put plug-in cards. My first laptop could only use a special internal modem designed for that computer alone, which sold at enormous cost. There was no way to hook up a LAN adapter or a sound card. But I guess that wasn't much of a problem, because LAN adapters and sound cards didn't exist then.

Nowadays everybody wants tiny computers, and everybody wants to hook gadgets up to computers. These two goals were mutually exclusive until the PCMCIA stepped into the picture. The organisation was formed in mid-1989, based on a standards committee of people from companies which would become leaders in portable computing.

A one megabyte static RAM PCMCIA card.

Memory makers Mitsubishi and Fujitsu were there, along with Silicon Storage Technology. Computer manufacturers included Hewlett-Packard's Portable Products Division, Poqet (early palmtops), NEC, and Toshiba. Microsoft was in on the act, as well as a fellow named Tom Cruise (no, not THAT Tom Cruise) from Molex International. He would have been interested in the connectors (68 little bitty pins) between the cards and the computers, as was Stan Sharp from ITT Cannon.

Their initial concern was with memory cards for the little palmtop computers like the Hewlett-Packard HP95LX. Hence the organisation's name. But then somebody said "If we can plug a memory card in there, why not a modem? And if a modem, why not..." Well, you get the idea; the thing grew like topsy.

As well as scrunching plug-in cards down to credit card size, the PCMCIA had another goal: to get rid of all those DIP switches. In fact, their hope was to free the user of installation procedures altogether. Users could simply plug the card into the computer's socket, and the card would do what it was supposed to do, automatically. In other words, 'PLUG AND PLAY'!

Talkative tuples

For a plug-in gadget to work, the computer obviously has to know what the gadget is, and how it should be configured. All the computer initially knows is that a PCMCIA card has been inserted. This is signalled when ground appears on two Card Detect pins, one at each end of the connector. So the card must be correctly inserted all the way into the socket, for both pins to make contact.

Within each PCMCIA card in an area called 'attribute memory'. This contains many strings of data bytes describing the function and setup of the card. Each of these strings is called a 'tuple'. Tuples contain information such as what the card is supposed to do, who manufactured it; and if it is a memory card, what format is used (disk drive or straight memory?). There is even a tuple to tell the computer when a memory card's battery was last changed. The whole collection of tuples is known as the 'Card Information Structure' or CIS.

When the computer detects the presence of a PCMCIA card, it switches to the card's attribute memory and starts interrogating the tuples. The card

responds with something like 'I am a Netcomm modem, capable of running at 14400 baud'. Or maybe it will say 'I am a one megabyte memory card, I am formatted like a MS-DOS disk drive, and I think my battery is going flat'. The computer then organizes its affairs accordingly, and the card swings into action.

Card & socket services

Let's forget about the cards for the moment, and look inside the computer. The first thing we see is a slot containing that 68-pin connector, which in turn hooks to some kind of controller chip. So far the computer is not even aware of the socket's existence. There must be a software driver to recognise the socket, and the fact that a card has been plugged into the socket. This driver is known as 'Socket Services'.

So the computer now knows that the socket exists, there's a card in it, and it knows what the card is supposed to do. But further software is needed to tell the computer how to *use* the card it's just found, how to allocate computer resources such as memory and so on. This job is done by a further driver called 'Card Services'. Note that Socket Services must be present before Card Services can work.

These two drivers lay the groundwork for 'plug and play'. But a further driver called a 'Client' is usually needed to manage a specific card; for instance a third driver is necessary to implement an MS-DOS disk file system on a PCMCIA memory card.

In earlier notebook computers, Card and Socket Services, and specific card drivers, exist as disk files which must be loaded into the computer's memory every time the computer is booted. I understand later notebooks include this stuff in ROM, so it's always available without bothering the hard disk.

Point enablers

If you only intend to use one PCMCIA device instead of swapping them around, there is an alternative to all the complication of Card and Socket Services. This is a small program called a 'point enabler' which is specific to a particular PCMCIA card and is usually supplied on disk when you purchase the card.

The Banksia PCMCIA modem card comes with a point enabler with the strange name of HITME (as in 'Hit Me With That Rhythm Stick'...). This little file of only 12KB takes the place of all the Card and Socket services stuff that totals well over 100KB. When you want to use the modem you just run HITME and the modem is yours. Even though the point enabler is supposed to be specific to one card, I found the Banksia HITME worked equally well with a Netcomm modem.

Card types

All PCMCIA cards have much the same length and width as a credit card — 85.6 x 54mm — but their thicknesses vary. You will see PCMCIA cards referred to as Type I, Type II, and Type III etc. These numbers only refer to the card's thickness, of 3.5mm, 5mm or 10.5mm respectively. Regardless of the thickness, the connector is always the same distance from the bottom of the card. So if your computer has a Type III slot and you insert a Type I card, it will fit into the connector fine but there will be a certain amount of air space above it (see the photo).

The Netcomm PCMCIA modem, with telephone connections.

Type I cards are usually memory cards. Type II cards are things like modems or LAN adapters, and are a little thicker to allow room for some (tiny) components. Type III cards are thick enough to contain something like — wait for it! — a complete 105MB hard disk drive. These appear to be aimed at multiple users of the same computer, who can take their personal collection of files with them beforé handing the computer on to someone else. The 'PocketFile' PCMCIA hard drive card even includes a little leather pouch for popping the hard drive into a shirt pocket.

Memory cards come in two flavours: static RAM (SRAM) and flash memory. Static RAM is the type that has been around for years; it doesn't need constant 'refreshing' from the computer's microprocessor to retain its contents. SRAM is of CMOS construction, and it only needs a tiny current from a battery to keep its memory contents intact. In a PCMCIA SRAM card there is a small slot in one end containing a watch battery, which in theory should keep the memory alive for one year.

I bought two PCMCIA one-megabyte SRAM cards about two years ago, and back then they cost nearly $400 each. Now I see similar cards are on sale in the USA at least for only $45. Just like other new technology, they obviously came down in cost with volume production.

My SRAM cards have been running for two years on their original batteries. Every now and then the computer complains about 'low card battery' but I've found it can be restored by removing the battery, wiping it with a clean cloth, and reinstalling it. The contacts are obviously getting slightly corroded.

One thing to watch out for in SRAM cards is that they come in both 3.3 and 5-volt versions. The 5-volt versions are cheaper, so they are sometimes what you get for discount deals. Palmtop computers such as the HP95LX run from a pair of 1.5 volt penlight cells, and rumour has it that 5-volt SRAM cards will flatten the computer's batteries very quickly.

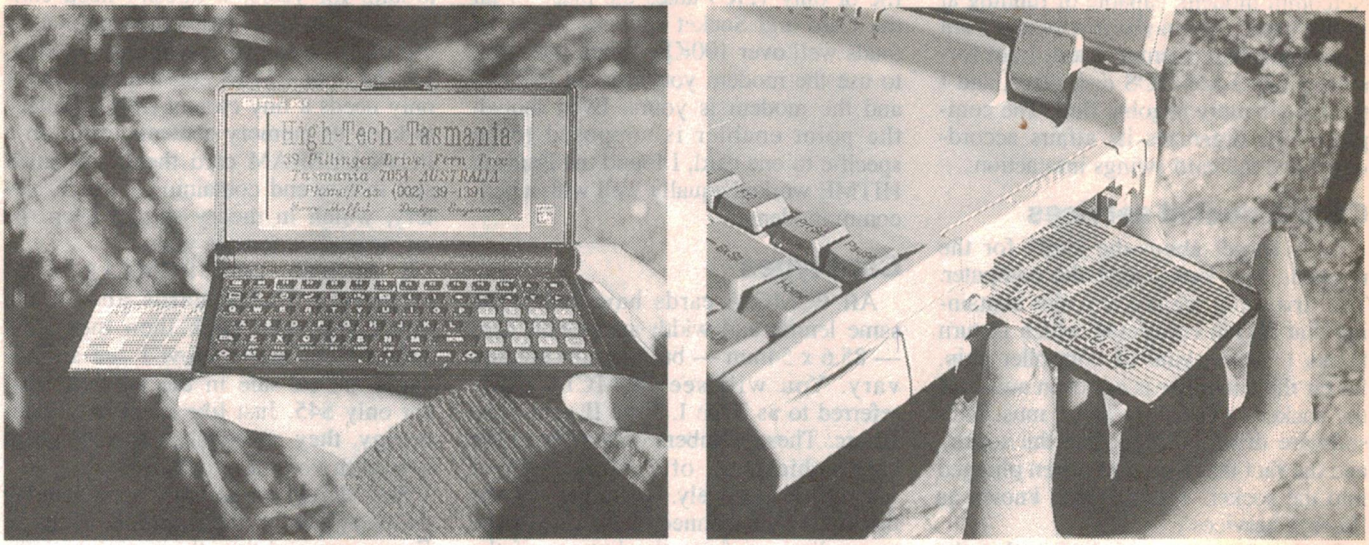
Flash memory is a bit like electrically erasable EPROM. It takes a fair whack of energy to write to flash memory, but once it's written, no energy is required to maintain the contents. In other words, no batteries. A flash memory card can hold over 20 megabytes, and some computers such as the Hewlett-Packard Omnibook use a flash card as a hard disk (an option is a 'proper' mini-hard drive which fits in the computer's PCMCIA slot).

Flash memory is specified to have a limited number of write cycles, just like any other EPROM. Some users feel a little nervous about this, but by the time you approached the limit (say 10,000 writes) the computer itself would probably be over the hill anyway. Don't worry, be happy.

How PCMCIA works

While preparing this article I sent off a flurry of faxes to suppliers of PCMCIA devices all over Australia, asking for in-

PCMCIA: Pretty Puny Peripherals



Left: A Hewlett-Packard palmtop computer. You can remove the PCMCIA memory card from its slot.... and transfer it into the Toshiba notebook computer (right). Note that the Toshiba slot is much thicker than the card.

formation on their product lines and possible loan of some of their goods. What I ended up with was two modems, from Netcomm and Banksia, as well as heaps of useful information from a company called Advanced Portable Technologies. I also did some snooping around on the Internet, to find out what kind of experiences other people were having with PCMCIA.

Most of the Internet messages were fairly pessimistic. The general opinion was that PCMCIA 'plug-and-play' was a good idea, but at this stage of its development it seldom worked. There were stories about this modem not working in that computer, and so on. The Toshiba notebook was particularly singled out, which was somewhat worrying to me since I am the owner of one of these 'dreaded' machines.

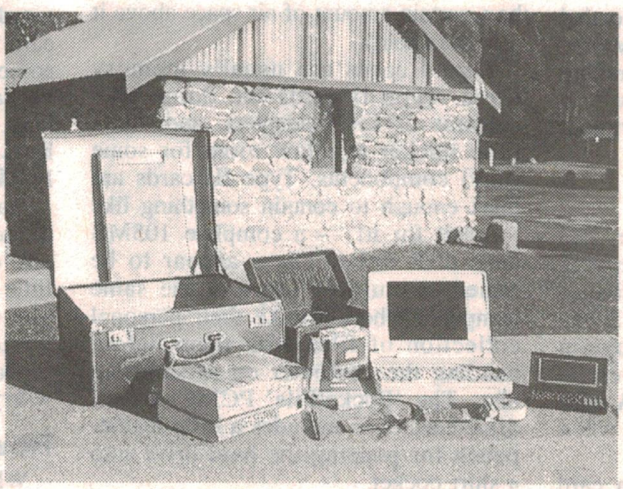
The Toshiba notebooks (and several others) have a 'resume' feature in which you can stop whatever you're doing and turn off the computer without bothering to exit the program or even save your files. When you switch on again sometime later, you find the computer just as you left it with the cursor blinking away on the last word you typed. Toshiba users complained that their modems would not survive 'resuming' and would usually lock up.

Well, Toshiba *did* have a problem. The first release of their Card and Socket Services software was a dud. I could never get it to work even with my SRAM memory cards. But Toshiba knew of the problem and soon came up with a new version, Release 3, of Card and Socket Services. This was offered to existing Toshiba users free of charge. Internet people said Release 3 still wouldn't work properly, but I pressed on with Release 3 and got it running beautifully.

It was the same old problem, I think: 'If all else fails, read the instructions'. I followed the Card and Socket Services instructions to the letter, 'excluding' specified areas of memory so other programs couldn't use them. I also properly installed the computer's power manager, which seems to affect how the resume mode works.

Once this was done I could 'plug and play' with wild abandon. I could plug in one of the SRAM cards and it would magically appear as the Toshiba's E: disk drive. I could pull out the memory card and plug in one of the modems, even while the power was still on (this is called 'hot-swapping'). The computer would think about things briefly, obviously reading in the card's tuples, and then beep to say 'OK, here is your modem, connected to COM2:'. If I pulled out one modem and plugged the other one in, again hot-swapping, the computer would have another brief pause to read the new card's tuples and then beep again.

As for resume mode, it worked great, even under Windows. When I turned the computer back on after a break, there would be the small delay and then the beep, just like when a card is swapped. Card and Socket services was obviously reading a fresh copy of the tuples after the card powered up. I suspect failure to do this, due to faulty installation, was the cause of other people's resume troubles.



The portable office, ready for action at 'The Springs' recreation site on Mt. Wellington.

What this means is that Toshiba's Card and Socket Services software was handling the whole PCMCIA kaboodle. I could take a new modem card straight out of its box, slide it into the PCMCIA slot, and Bingo! Away it would go. There was no real need to resort to the particular modem's own software or installation procedures.

Life might not be so easy if we were working with PCMCIA sound cards and network adapters, along with the collection of modems and memory cards. I never got to try any of these

things, but I would say on the performance so far, 'plug and play' — or at least Toshiba's version of it — looks pretty promising. It's certainly got me hooked!

What's it good for?

I am quite convinced that more and more computers will be portables, and the desktop as we know it will eventually vanish. We now see office workers no longer having offices, due to costs, and instead they're working from their cars, or their homes. In other words, desktop computers are facing a shortage of desks. The front seats of cars are becoming desks. So are picnic tables at the beach or in the mountains, and so is the human lap.

I read in the paper recently that by the turn of the century, 75% of all workers will use computers in their work. And what we're talking about is portable computers — laptops, notebooks, palmtops, and now 'personal digital assistants' like the Newton and the Zoomer. And every one of these computers will have PCMCIA slots.

'The Portable Office' — is it just a buzz-word? Not any more. Permit me to demonstrate. Laid out in the photo, taken at one of my 'workplace' sites on Hobart's Mount Wellington, is my own portable office. Everything you see there fits into the big brown case at the left rear of the table. Contents include:

- Toshiba T1900 notebook computer.
- Hewlett-Packard palmtop computer.
- Spare batteries for both computers.
- Clipboard with paper and pen.
- Reference books being used with current project.
- And finally, an old Bolex cine camera case containing...

Power adapter for notebook computer
Trackball/mouse for notebook computer.
Small box of disks including emergency boot disk.
Larger box of disks.
Spare one megabyte PCMCIA SRAM disk.
PCMCIA modem
Telephone cord for modem.

So now you know the truth. The real home of Moffat's Madhouse is a big brown box!

Most adverts for the 'portable office' you see in computer magazines show a flashy briefcase, carried by a well-to-do man in a suit. My case was given to me as scrap and it's so daggy you'd never know it was loaded with thousands of dollars worth of computer gear.

There are a couple of things NOT in my portable office. One is a printer, and the other is a mobile telephone. I have recently purchased a little Canon Bubble-Jet printer, primarily for an upmarket weatherfax project I am working on. It works great for normal use as well, with both graphics and text, but I find in practice I seldom use it. Most material I would normally print, such as business letters, now goes out as fax instead. Anything that truly needs to appear on paper can wait until I get to where the printer is.

As for the mobile phone, I am wavering. Most of my 'portable office' work occurs indoors, on the dining room table at either my home or the beach shack. Both these tables have phone connections right next to them. I've also got

The Winmax Data Race PCMCIA Combo Card combines a data and fax modem with an Ethernet 10BaseT twisted pair LAN adaptor, and can handle both functions simultaneously. It's available from Australasian Memory: phone (02) 899 5637 or fax (02) 899 2170.

one of those Panasonic portable phones that lets me work sitting on the beach, while remaining in contact through a little base station in the house. But I'm sure I'll have to get with the strength sooner or later, getting a proper mobile phone and one of those gadgets to connect my PCMCIA modem through it.

An article for *Electronics Australia* usually begins with note-taking somewhere, and that's where the palmtop computer comes in. Its PCMCIA slot has a one-megabyte SRAM card containing, among other things, a copy of my Video Display Editor word processor, identical to the one that lives in the notebook computer. The palmtop is particularly handy in the reference section of the State Library of Tasmania, where they seem to frown on notebook computers because of their cases. They think people might use them to pinch books. The palmtop's keyboard is also completely silent.

Once the research is done there are usually several small disk files on the palmtop's SRAM card containing quotes from people or information from books, which is to appear in the final article. So I pull the SRAM card out of the palmtop and transfer it to the PCMCIA slot on my Toshiba notebook, where it becomes the E: disk drive. Then, using the copy of the VDE editor in the Toshiba, I can read in the files of notes which originated in the palmtop and merge them with the main article. This means the notes don't have to be typed twice. When the writing is done I remove the SRAM disk from the PCMCIA slot, replace it with the modem, hook up the telephone cord, and shoot the material up the line to the magazine.

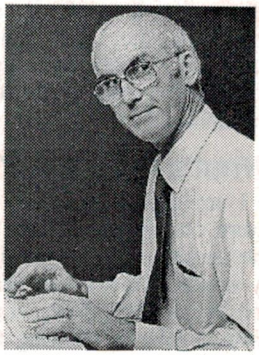
The only thing this doesn't work with is photos, which at this stage must be submitted by mail. But even this is changing. You may have noticed some pictures of Jupiter on the cover of *EA*'s October 1994 issue, and in the radio astronomy article. These were collected from the Internet via my PCMCIA modem and sent to *EA* on a floppy disk. These computer images could have been sent to *EA* just as easily via the modem. Unfortunately I can't do this with my own photos because I've got no way to convert them to computer images (yet).

So that's a look at the PCMCIA scene at the moment. But, as the old saying goes, you ain't seen nothin' yet. Waiting in the wings, possibly already in Australia by now, is a GPS satellite navigation receiver totally on a PCMCIA card. This device will hide in a Type III slot with only a tiny antenna poking out, and fix the position of the computer within a few metres anywhere on the surface of the earth.

You'll notice that there was only the briefest mention of modems in this discussion. That's because so much good stuff came from my investigations into modems that we decided to dedicate a separate article to them (already published in the December 1994 issue). I do have another article coming shortly, though, specifically about computer faxing. So stay tuned! ❖

FORUM

Conducted by Jim Rowe



More on the banning of CD's in planes, and do some CD recordings have 'rumble'?

This month we're mainly going to look at follow-up responses to the discussion in our April column, regarding the banning by airlines of portable CD player use during flight. However another reader draws our attention to a possibility that at first sight, may seem impossible: whether or not some recordings on CD have inbuilt rumble...

There's been quite a response to the discussion in April's column about the ban by airline operators on the use of personal CD players on planes, and I'm proposing to present some of the follow-up material this month. However just before we look at this topic, I'd like to present a letter that arrived just before the letters concerned — on the subject of 'rumble' on audio compact disc recordings. It's something we haven't discussed here before, but I suspect the author of this letter is not the only one to have had the experience he describes.

The writer concerned is Dr S. Frank, of Berwick in Victoria, and here's what he has to say:

For some years I have followed the responses of readers of your magazine about the pro and cons of compact discs — that is, the more 'transparent sound' produced by vinyl records compared with the 'harshness' of CD's. I prefer not to become involved in these discussions, as they are very much subjective, and often, one hears what one wants to hear (i.e., I fail to understand, and hear, how the monstrous copper cables connecting power amplifiers to speakers only a few feet away can make any noticeable difference to sound quality).

There is, however, a problem most audiophiles have struggled with for many years; this is the inadequate bass response of most mid-priced loudspeakers. G.A. Briggs in his book 'Loudspeakers', first published in 1948, and 'More about Loudspeakers', published in 1965, discusses various methods of extracting a clean, faithful bass from various speakers and enclosures. I have built some of these over the years, in timber and concrete, but the size, weight, and appearance made them quite unpopular around our home.

It was therefore with great interest when I read your paper on a new subwoofer design, using a 15" speaker with a carbon fibre cone. I constructed this enclosure, and, as recommended, combined this with the active subwoofer crossover published earlier, and your Playmaster power amplifier in bridged mode output stage. The mid- and high frequencies were nicely reproduced by a set of Jamo speakers.

The sound from this combination (the subwoofer hidden behind the couch) is quite outstanding. Organ notes I have never heard before were suddenly there, clean and undistorted. Although the temptation is often present to increase the bass level, I believe I have found a fairly ideal setting for the majority of my CD's.

Low frequency noise...

There is however a problem which has become more and more apparent; on quite a number of my full-priced DDD compact discs, there is very noticeable 'rumble' — a low frequency noise as noticed in the past, using vinyl discs and turntable combinations. This 'rumble' frequently varies with the bass content of the recording, and is never present between tracks.

Changing the CD player, pre- and power amplifier combination, made no difference whatever, nor did the placement of the subwoofer and satellite speakers. As the volume is increased on the subwoofer crossover, so increases the rumble. Other CD's (ADD, AAD), of older recording vintage, where I would have expected some problems, played perfectly well; no trace of rumble, just some surface noise at times.

After spending many hours trying to isolate and define the problem, I am forced to believe that some of the top-priced CD's are not quite as perfect as the manufacturers would make us believe.

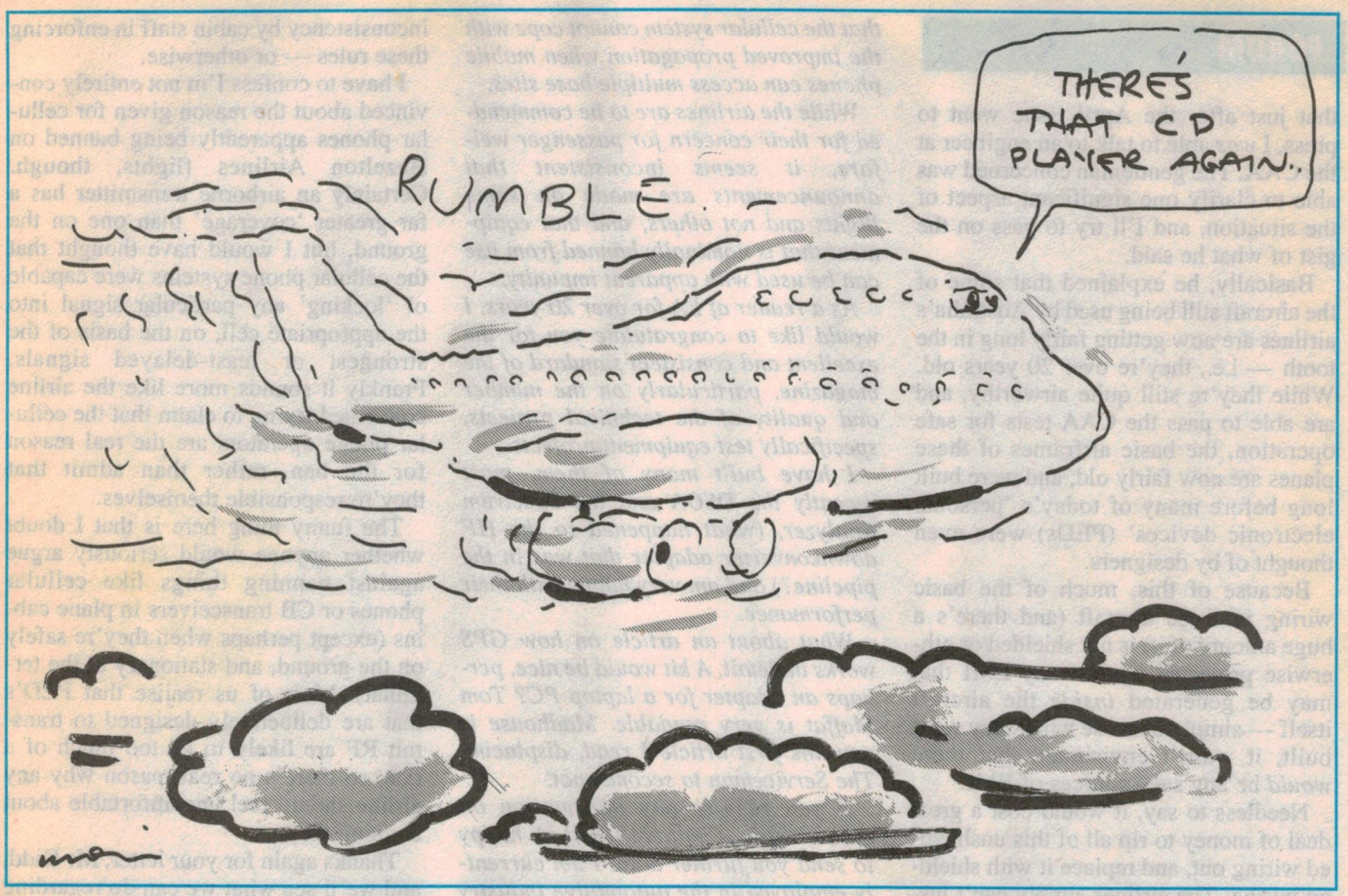
In the old days, trains, trams and road traffic near the concert hall or recording studio were not uncommonly blamed for some of the very low frequency content of the recordings, but the true source of the problem was mostly with the quality of the turntable, or its acoustic isolation from the sound source.

It is obviously possible to produce high quality CD's, where impeccable sound quality matches some truly outstanding musical performances, both in bargain and top priced CD's. To return CD's of lesser quality to the point of purchase is a useless exercise, as most of the shop assistants do not even know what 'rumble' is, and their final and definitive test is to play the disc on one of their rather mediocre sound systems in the shop — if it sounds OK there, to their ears, it must be OK. After all, this is a DDD recording; the best you can get.

I have discussed this problem of inferior CD quality with some professionals in the music industry, and most of them have had similar experiences. The Penguin Book on Compact Discs can be a useful guide to eliminate unsatisfactory performances, as well as recordings which lack technical merit, but it is surely up to the big recording companies to produce discs of high quality, which allow the performances to be reproduced on sound equipment which matches today's technology.

I would be interested to hear if some of your readers have had problems of a similar nature.

Well, there it is. What do you think? Have *you* noticed any rumble or similar low-frequency noise on your CD record-



ings, including those of the DDD variety? I suspect Dr Frank isn't alone, and that he may be right in believing that it's probably more common than the recording companies would like to admit.

Although I can't say I've noticed any rumble on any of my own CD's, that's probably just because nowadays I seem to do most of my listening on a relatively modest 'second system' in my study/workroom. This system has fairly small speakers, and certainly no subwoofer, so I doubt if I'd hear any rumble that may be present on the CD's I play...

If the problem *is* occurring, though, I wonder where the spurious low frequency signals are entering the recording chain? As Dr Frank mentions, in the analog vinyl recording days it was fairly clearly attributable to the playback turntable, its drive system and bearings. In the very rare cases where it was 'built into' a recording, it was almost always caused by a faulty recording lathe.

But in these days of digital recording chains, it's hard to see where low frequency rumble could be picked up in the system, and inadvertently added to the signal before it is used to produce the master 'cut' and stampers used to press the final CD's.

By its very nature, the digital recording system is designed to be virtually immune to things like wow and flutter. As the digital information carries its own timing 'clock' information, any minor speed variations in the playback medium speed can be automatically cancelled — at least in theory. I suppose many of us have assumed that this system would also preclude rumble, at least of the conventional variety.

All I can think of is that either some of the recordings concerned have been made in halls or studios with unavoidable rumble caused by passing traffic or underground trains, etc., or else for reasons of economy they've been made using analog master recorders.

Then again, I note that Dr Frank has found that the 'rumble' seems to vary with the bass content of the recordings, and isn't present between tracks. I suppose *that* could mean that we're not talking about rumble of the traditional variety at all, but low frequency noise introduced by some sort of intermodulation phenomenon — or originating in microphone preamps, and gated out between tracks by muting circuits.

Perhaps someone working in the recording industry can help clarify things for us. Anyway, I think you'll agree that it's an interesting topic, and my thanks to Dr Frank for drawing our attention to it.

CD player ban

Now let's return to the subject of portable CD players, and the ban on using them during flights. But before I present the letters from people responding to the discussion in the April column, I'd like to make a couple of follow-up comments of my own.

Firstly, as I mentioned at the end of the April column, I tried to get figures on measured EMI radiation levels from portable CD players, from one or two of the leading manufacturers. As it happens, I drew a blank here — none of them wanted to release this information.

I got the strong feeling that this isn't because the radiation levels are in themselves unduly high, or otherwise embarrassing, but simply because they sense that this is a potentially 'political' question. Presumably they don't want to get involved in case there could be a detrimental impact on future business, arising from their being seen to embarrass the airlines or perhaps the CAA.

The other comment I'd like to make is

that just after the April issue went to press, I *was* able to talk to an engineer at the CAA. The gentleman concerned was able to clarify one significant aspect of the situation, and I'll try to pass on the gist of what he said.

Basically, he explained that some of the aircraft still being used by Australia's airlines are now getting fairly long in the tooth — i.e., they're over 20 years old. While they're still quite airworthy, and are able to pass the CAA tests for safe operation, the basic airframes of these planes are now fairly old, and were built long before many of today's 'personal electronic devices' (PEDs) were even thought of by designers.

Because of this, much of the basic wiring in these aircraft (and there's a huge amount of it) is not shielded or otherwise protected against any EMI that may be generated *inside* the aircraft itself — simply because when they were built, it wasn't envisioned that there *would* be any such sources of EMI.

Needless to say, it would cost a great deal of money to rip all of this unshielded wiring out, and replace it with shielded wiring. The airlines simply can't justify the expense, considering the age of the aircraft, and on the other hand the CAA can't insist that it be done — because the aircraft are still able to meet their original airworthiness specification.

The bottom line, then, seems to be that the only way the airlines can ensure that these aircraft can be flown safely, is to insist that certain 'suspect' PEDs are not operated inside the cabin during flight. Which sounds fair enough, I suppose, especially if you're a passenger or crew member!

With those comments as a kind of preamble, then, here's the first follow-up letter on the topic from a reader. It comes from Richard Kidd VK2TED, of Orange in NSW, who has this to say:

I thought that the information on page 121 of the attached copy of 'Panorama' might be of interest.

There was also an inflight announcement on one leg of the return flight but not the other. This was substantially similar to the information in the magazine, but I noted a number of passengers using portable CD players with no apparent interference by the cabin crew.

Hazelton Airlines display a sign at their ticket counter regarding the prohibition on the use of cellular phones in flight, but the concern seems to be more that the cellular system cannot cope with the improved propagation when mobile phones can access multiple base sites.

While the airlines are to be commended for their concern for passenger welfare, it seems inconsistent that announcements are made on some flights and not others, and that equipment that is nominally banned from use can be used with apparent impunity.

As a reader of EA for over 20 years, I would like to congratulate you for the excellent and consistent standard of the magazine, particularly on the number and quality of the technical projects, specifically test equipment projects.

I have built many of them, most recently the DSOA and the Spectrum Analyzer, (what happened to the HF downconverter adapter that was in the pipeline?) and am very happy with their performance.

What about an article on how GPS works in detail. A kit would be nice, perhaps an adapter for a laptop PC? Tom Moffat is very readable. Madhouse is now the first article I read, displacing The Serviceman to second spot.

If you require any information on auto electrical matters I will be happy to send you further data. I am currently employed in the automotive industry as a service manager with a Mercedes-Benz and Toyota dealer, but being an ex-TAFE teacher with a hobby of collecting old workshop manuals, I have a lot of obsolete information (back when wiring diagrams for cars were postcard size!).

Thanks for those comments, Richard. By the way, I'm reproducing the relevant section extracted from the March 1995 issue of Ansett Australia's magazine *Panorama*, here so that other readers will be aware of what it says:

Electronic devices *Hand-held video cameras, portable palmtop and laptop computers, compact disc or cassette players, personal organisers or personal video games can be operated only while the aircraft is in cruise. The following cannot be used at any time on board an aircraft: commercial video camera, video recorder, TV receiver, large tape recorder or portable telephone.*

As you can see, Ansett appears to allow portable CD players and other PED's to be used during cruise flight, at least officially, while still banning items such as commercial video cameras and recorders, and 'large' tape recorders. It would be interesting to know why the latter are banned outright, and also why in practice there seems to be some inconsistency by cabin staff in enforcing these rules — or otherwise.

I have to confess I'm not entirely convinced about the reason given for cellular phones apparently being banned on Hazelton Airlines flights, though. Certainly an airborne transmitter has a far greater 'coverage' than one on the ground, but I would have thought that the cellular phone systems were capable of 'locking' any particular signal into the appropriate cell, on the basis of the strongest or least-delayed signals. Frankly it sounds more like the airline concerned trying to claim that the cellular phone operators are the real reason for the ban, rather than admit that they're responsible themselves.

The funny thing here is that I doubt whether anyone would seriously argue against banning things like cellular phones or CB transceivers in plane cabins (except perhaps when they're safely on the ground, and stationary at the terminal). Most of us realise that PED's that are deliberately designed to transmit RF are likely to be too much of a risk, so there's no real reason why any airline should feel uncomfortable about banning them.

Thanks again for your letter, Mr Kidd, and we'll see what we can do regarding your suggestions of an article and project on GPS. Thanks too for your kind words about the magazine.

Electric shavers?

Moving on, our next letter came from Mr John Johansen of Noranda in WA, who has this to say:

Thank you for a very interesting and well conducted Forum column, as it always contains food for thought.

I would like to add to the discussion about CD players on planes.

As a technician I used to fly frequently, within W.A. and on the 'red eye express' (midnight) to Sydney. I have on many occasions used an electric shaver on board, usually in the toilet that is located somewhere in front of the aircraft.

The shaver has a commutator (arcing?). Nobody has ever told me not to shave (even on 747's).

A further thought! Electric toothbrushes would also emit a fair bit of EMI. I suppose flight crews do not notice the use of these appliances in the toilets — out of sight, out of mind.

Thanks for your comments too, Mr Johansen. Like you, I've also seen passengers using their own electric shavers on flights (especially long international

flights), and I don't doubt that electric toothbrushes are also used as well.

Now although many (perhaps most) of these units seem to be fitted with a commutator-type motor, with its potential for sparking and generation of EMI, I think many of them are also fitted with suppressor inductors and capacitors — designed to at least attenuate the radiation. But exactly how effective these suppression capacitors may be, is probably a good question.

I guess the question that Mr Johansen's letter raises in my mind is this: if the (probably quite tiny) amount of radiation from a portable CD player is supposedly capable of causing malfunction of a plane's navigational or other systems, how confident can either we or the airlines be that an electric shaver or toothbrush poses no risk? It's a pretty relevant question, I think.

What about lightning?

Moving on again, the next letter came from H.L. Harvey, of Taringa in Queensland. As you can see, Mr Harvey isn't too convinced by the letter from Qantas:

Re CD players, laptops etc. in aircraft, (Forum April 1995), I have very grave doubts about the Qantas explanation. In aircraft design it is particularly necessary to incorporate a high factor of safety in the performance specifications of all components.

For example, although a passenger jet would very rarely have to fly through a thunderstorm, nevertheless it would have to be able to cope with a possible emergency landing under such conditions. Therefore the vital electronics equipment would have to be adequately shielded and decoupled from other wiring to ensure minimal effect of the intense EM radiation associated with lightning strokes. The metal hull would in effect be a Faraday cage for electric fields, but would be penetrated by magnetic fields caused by thousands of amps of steep wave-front currents in adjacent lightning strokes.

If indeed the aircraft electronics are protected to this extent, I fail to see how they can be affected by very weak EMI from CD's, laptops etc., even though they are within the Faraday cage.

If there is substance in the Qantas official's explanation and the vital electronics are not adequately protected, then heaven help the aircraft and all aboard if they have to do an emergency landing in a thunderstorm.

Thanks for those comments too, Mr Harvey. Your point about the magnetic field from nearby lightning discharges is a good one, I think. It's hard to see how the weak radiation from things like CD players would be capable of causing trouble, if the aircraft's equipment really is properly protected against the fields from nearby lightning discharges, isn't it?

Even on the ground...

Moving on again, our next letter came from Mr Will McGhie VK6UU — one of the radio amateurs who took me to task recently for my comments about the SMA fee rise. It seems that Mr McGhie may still be reading the magazine, because here's what he had to say about the present topic:

The comments on electronic devices on commercial aircraft interest me, as I have had practical experience on the applications of these rules.

A domestic flight I was on, aborted take off half-way down the runway and returned to the terminal. A minor fault had to be repaired with one of the engines. The repairs took two hours.

During this time, passengers were not allowed off the plane and also were not allowed to use their mobile phones. This was annoying, as contacting people expecting you at your destination would have allowed them to rearrange their day.

All attempts to try to understand why a mobile phone could not be used while the plane was on the ground at the terminal, with little if any of the electronic equipment working in the plane, resulted in the same response: 'No mobile phones are allowed to be used on the plane'. The cabin crew were simply following standard orders, that were not flexible enough to foresee this situation.

I wrote to Qantas and asked why a mobile phone could not be used in this situation, and received a standard reply that 'No mobile phones are allowed to be used on aircraft'. No explanation specific to this situation.

Several weeks later, another letter arrived from Qantas asking if the response to my query was satisfactory, to which I replied no. I received no further response from Qantas.

Another point of interest is external RF. For example I have been in aircraft that have flown close to television transmission towers. The combined RF from some of these towers, that have high power UHF and VHF transmissions must be considerable. How much of this energy is able to penetrate an aircraft and have the potential to interfere with aircraft operation?

The interface between the technical people and the administrators who issue the rules is also an area of interest. I'm an electronics technician, and if I worked in the electronic maintenance of aircraft and was asked is it 100% safe for all types of electronic devices being used on an aircraft, then I would have to say no. I know enough about electronics to never be able to say with 100% certainty that a given situation could not happen; but is 100% safe realistic?

The point I make is, if the managers and administrators ask the question, 'Is it 100% safe to allow all manner of electronic devices to be used on aeroplanes?', then the answer would have to be no. So what does the manager do? This person has to make the decision and the easiest and safest decision is to ban all electronic devices, no matter how unlikely they are to interfere with the operation of the plane. The decision gets down to the difference between 99.999999% and 100% safe, no matter how stupid the result may be.

What examples do the aircraft industry have of interference by electronic devices in aircraft?

Accuracy important

The correct reporting of such incidences is important, as it is so easy for reports to be misleading. I can give an example of inaccurate reporting.

A motorist was reported as causing a fatal accident while using a mobile phone while driving. At the court case the motorist said he was not using the mobile phone, but had attempted to stop it sliding off the passenger seat onto the floor. This distraction had contributed to the accident. It is true that the mobile phone had contributed to the accident, but the absence of complete reporting resulted in the wrong conclusions easily being drawn.

What is needed is research into what dangers might or might not exist with electronic devices inside aircraft. I have the impression that very little is known, and the safest option is to ban all such equipment. The interface between the technical world and the managers is where it often goes wrong.

Thanks for those comments, Mr McGhie, and for describing your experience in being banned from using a cellular phone even when the plane was delayed and stationary on the tarmac for two hours. This is certainly hard to understand, although as you say it's probably attributable to a simplistic interpretation of 'standing orders' by the cabin staff. Still, it wasn't exactly an example of good customer relations, was it?

I take your point also about the need to be realistic in terms of the attainable degree of safety, in this kind of situation. Perfect safety is simply not attainable in the real world, after all. A finite element of risk is always going to be present; the real question is whether or not that risk has been reduced to a level that is accepted, by those involved. Perhaps this is the kind of concept that is hard to explain to non-technical people like accountants and lawyers...

Complex situation

Now let's look at our last letter, for the present at least. It came from Colin MacKinnon, of Glenhaven in NSW, who has contributed feature articles to *EA* in the past, as well as joining in discussions here and in Neville Williams' 'When I Think Back' column.

Colin's latest letter is quite long, and he also encloses copies of articles on the subject from overseas journals. It's all a bit too much to reproduce in full, so I'm proposing to present extracts. Here's what I believe are the most interesting parts of his letter itself:

Re your article in April's EA about EMI on aircraft. The possibility of EMI from consumer devices is a complex and as yet undefined problem. Manufacturers of consumer electronic products are resisting compliance with more stringent, lower EMI radiation regulations, and these regulations only cover EMI caused to nearby ground based receivers (in the broad sense). What PED's can do to very sensitive electronics in the confines of an aircraft is not covered adequately.

There have been at least two cases in Europe (in Germany, I think) where military aircraft crashed, and the most likely cause was EMI to the 'fly-by-wire' controls from very high power ground radar.

You mentioned (Editor: in a telephone conversation) *the older aircraft, with miles of wire. I've seen bundles 50mm or so in diameter, running from nose to tail in a 747, during a major overhaul. These are not all shielded, so can act as antennae. The newer aircraft are fly-by-wire with multiplexing and fewer cables, but with digital electronically controlled actuators at the mechanical interface. There is still potential to pick up signals via any unshielded wiring, and also direct into the electronic boxes. They will use optical fibre in the future...*

As you know, digital equipment with fast pulses can create harmonics of significant levels at surprisingly high frequencies. If everyone on an aircraft used a PED, who knows what intermods and signals would be floating around. High power devices like mobile radios and phones are obviously suspect, but some other devices also put out significant amounts of RF.

On a somewhat related subject, there is a big push to lower voltages of operation of electronics — e.g., CPU's are now at 3.3V, and the expectation is to get down to 1V for lightweight battery operation (in hand held computers), within about two years. That's all very well, but what does it do to the device's immunity to external fields?

Critical in the future

EMC will become very much more critical in the future (not too far away), and the administrators and regulators are way behind in coping with the changes.

Incidentally, EMC has become so big in the USA and Europe, that there are monthly magazines like the one reference herein, and the IEEE has a standalone division to discuss EMI/EMC.

I think these are the most interesting sections from Colin's letter. He also included two articles from the magazine *EMC Test & Design*, one dealing with the problems of protecting electronic equipment from interference by high-intensity radiated fields, and the other more specifically with the dangers to aircraft systems from radiation by portable electronic devices. The latter article had apparently been reprinted from *IEEE Spectrum* for February 1994 (Volume 31, Issue 2).

My thanks to Colin MacKinnon for sending this material, which I found very interesting.

Perhaps the best way to end up this month's discussion, though, is to note that in the USA, a body known as the Radio Technical Commission for Aeronautics (RTCA) has apparently conducted a fairly thorough investigation into the risks from PED use in aircraft. Its findings may have already been released, but I haven't been able to determine this as yet. If we can get hold of a summary of the RTCA's report, it should make interesting reading.

And that's it for this month. I hope you'll join me here again next time. ❖

Experimenting with Electronics

by DARREN YATES, B. Sc.

Putting transistors to work, continued

This month, we continue with our look at some common transistor circuits from the audio and digital domains, plus a few of the more unusual ones.

When you sit down to select a few circuits for discussion, you quickly realise just how many different and useful transistor circuits there are — and they number into the hundreds. Some, grant you, are variations on a theme; but each one enables you to perform a task that couldn't be achieved before.

It's also the time when you discover just how versatile a component is — any component that works in both the digital and analog domains, can oscillate, amplify, control, filter, slice, dice and do your maths homework (only joking!) is one worth getting to know well.

Anyone for digital?

When it comes to building digital circuits, most designers (I guess those not on a budget) head straight for the IC packages. In most cases, that's fair enough — except when you find a circuit which only uses *one*, out of say four gates. Not only is this wasteful, but it can also be very annoying when you've used your last 4001 IC...

Provided your circuit isn't too critical, you can 'roll your own' gate using a couple of diodes and a transistor. Back in the May 1995 issue of *EA*, we looked at building AND and OR gates using a pair of diodes. Well, if we add a transistor to these two diodes, we can make also NOR, NAND, XOR, XNOR and inverter gates.

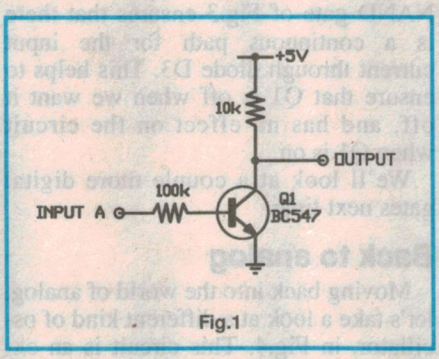


Fig.1

The first circuit, in Fig.1, is that of a simple inverter. As you can see, two resistors and a transistor make for a very simple circuit. The idea of it is to 'invert' the logic signal, as its name suggests. If we connect the input to ground, the transistor is off and the output voltage is equal to the supply rail (because there's no current flowing in the collector resistor). If we use digital terms, putting a 0 on the input gives us a 1 at the output.

On the other hand if we connect the input to the supply rail, the transistor turns on hard, pulling its collector and the output low, to near ground. Again, in digital-speak, a 1 or 'high' on the input gives us a 0 or 'low' on the output. So the circuit *inverts* the input signal, as we wanted. Pretty simple, but you'd be surprised just how many other building blocks use this little circuit.

In fact, let's take a look at one of them in Fig.2. By combining the diode OR gate we looked at in May with this inverter, we can come up with the NOR (NOT OR) gate.

For those of you who haven't spent much time with digital circuits, we'll go over these gates in a bit more detail. Assuming that you understand how the OR gate works from before, the NOR gate works on the following principle: The output of the NOR gate is low if either or both inputs is high. Now we can check our circuit against this rule.

Let's say we pull INPUT A high and keep INPUT B low. The base of Q1 is high, Q1 turns on and the output is low. It should be fairly easy to see that the same can be said if we swap the inputs over. If we pull both inputs high, the base of Q1 is again pulled high, Q1 is turned on and the output pulled low.

But if we force both inputs to ground, the base of Q1 is low, Q1 is off and the output remains high.

Another interesting point to note is that if we connect both inputs together, then we create an inverter. At the mo-

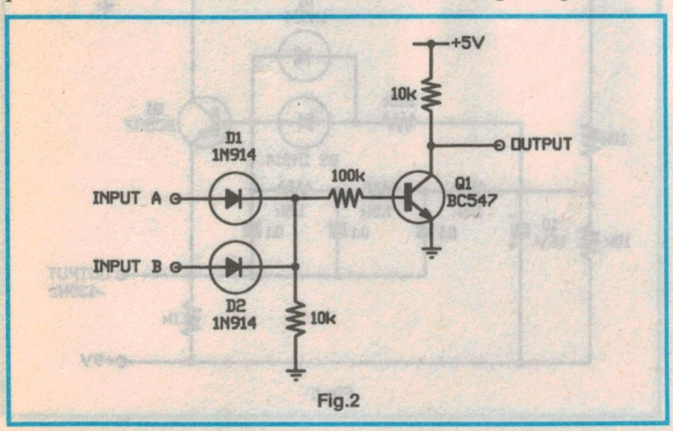


Fig.2

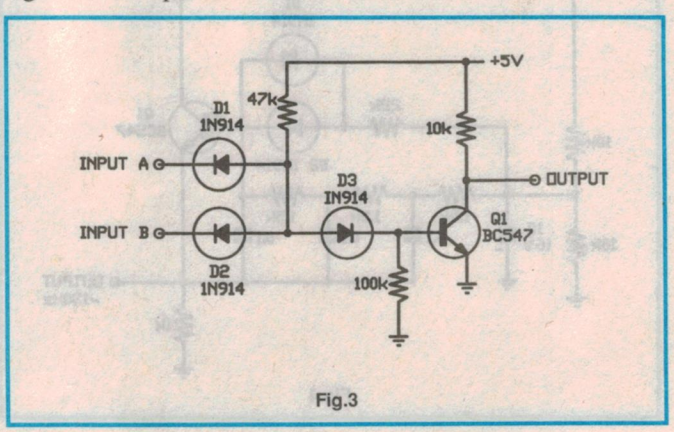


Fig.3

ment while we're playing around with transistors this doesn't mean an awful lot, but if you're using digital ICs, you can make an inverter out of a NOR gate or a NAND gate by simply connecting both inputs together.

Fig.3 shows the transistor circuit for a NAND (NOT AND) gate. Again, as before, we simply join up the diode AND gate with our inverter; however notice the extra diode before the base of the transistor. It may not be obvious at this stage, but without the diode, the circuit won't work.

If we just look at the circuit itself for a minute, pulling both inputs to ground means that we have a voltage drop of 0.6V at the base of the transistor. This is due to the drop across the diodes. Now 0.6V is enough to turn the transistor on. Ideally, we want to pull the base of the transistor as low as we can go; but the voltage drop across the diodes prevents us.

The easy solution is to add in an extra diode drop between the input diodes and the base. Now when we pull the inputs low, we still get 0.6V at the junction of the two input diodes, but the extra diode drops this voltage to around 0.1V at the base, which is not enough to turn Q1 on. So that's the reason for D3.

The golden rule for the NAND gate is as follows: The output of a NAND gate is *low* only when both inputs are *high*.

So testing our circuit, if we pull INPUT A high and force INPUT B low, the junction of the two input diodes is at 0.6V. Diode D3 drops this further, so Q1 is off and the output is high. Again, swapping over the inputs doesn't change this result; nor does forcing both inputs low. But if we pull both inputs high, the input diodes are reverse biased so diode D3 sees the full supply voltage, via the 47kΩ resistor. This allows a forward-bias current to flow into the base of the transistor, turning it on so that its collector voltage drops to nearly zero.

There are another couple of differences between both the NOR and NAND circuits, that are worth looking over from an electrical point of view. The NOR gate in Fig.2 has an extra 100kΩ resistor in series with the base. This is primarily a current limiting resistor, otherwise the input voltage would have a clear run direct to ground through a diode and the transistor's base-emitter junction, most probably blowing up the lot.

The 100kΩ resistor to ground on the NAND gate of Fig.3 ensures that there is a continuous path for the input current through diode D3. This helps to ensure that Q1 is off when we want it off, and has no effect on the circuit when Q1 is on.

We'll look at a couple more digital gates next time.

Back to analog

Moving back into the world of analog, let's take a look at a different kind of oscillator, in Fig.4. This circuit is an extremely handy and useful sinewave oscillator and quite a deal more unusual than most audio oscillators. It also has the benefits of having individually-controllable DC output voltage, distortion and frequency. You can also use just about any small signal transistor as well.

The most unusual thing about this circuit is that it doesn't appear to have a voltage gain, especially with the transistor connected up in a fashion similar to a common collector or 'emitter follower' circuit.

But what the circuit lacks in voltage gain in the emitter follower, it makes up for in resonance. The three-pronged RC filter or phase-shift network actually has a voltage gain slightly above unity at the frequency of resonance — somewhere of the order of about 1.12 or about 1dB.

In this circuit, the phase shift network sits between the base and emitter of transistor Q1. Now assuming Q1 has a beta of 100, the voltage gain of the emitter follower is 0.99. Multiply that with the 1.12 voltage gain of the network, and we have above- unity gain. Since the feedback from the emitter is positive, we have all the conditions necessary for this little circuit to oscillate, which it does quite nicely.

Provided all the R's and the C's are equal, the frequency of oscillation is approximately equal to:

$Fo = 1/(48 \times R \times C)$

Now this is only approximate, but you shouldn't have too much trouble selecting the components for the frequency you desire.

The distortion of the circuit is controlled by retarding the amplification of the circuit so that it doesn't run away. The 22kΩ resistor and the two back-to-back diodes limit the signal once it rises about around 0.3V. At this point the diodes are starting to turn on, and this reduces the overall signal.

With the component values shown, you should be able to achieve a total harmonic distortion figure of around 0.1% (In simple terms, this means that at any given amplitude, 0.1% of the signal consists of unwanted harmonics of the oscillator frequency. The lower that percentage is, the better!)

When changing the components to allow the circuit to run at a different frequency, you'll have to also consider the value of the 22kΩ resistor. If this component is too low in value, it will retard the gain to the point where it just won't oscillate.

Too high a value and it won't retard enough — and all you'll end up with is a big fat squarewave. This is because the diodes also add their own com-

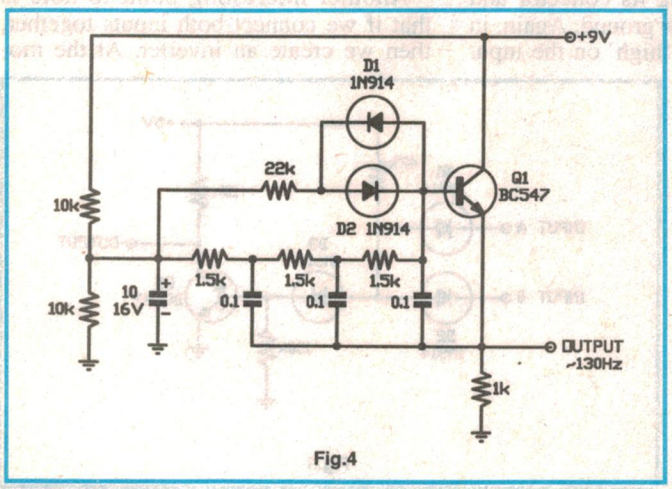


Fig.4

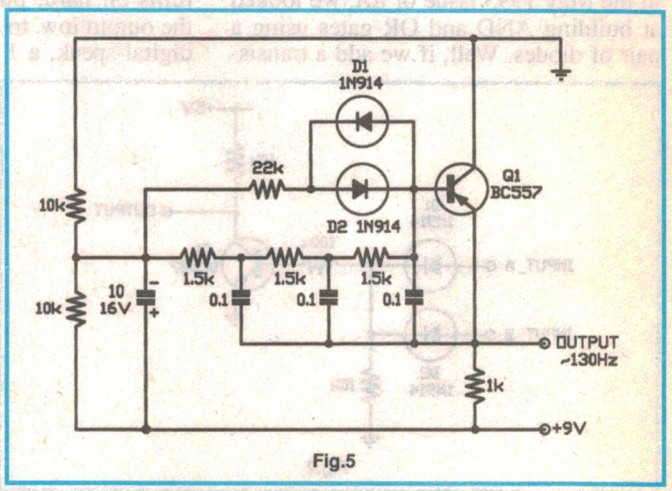


Fig.5

ponent of distortion into the equation, while controlling the signal level.

The trick is to get the diodes to do 'just enough', and you'll find that this occurs when the signal amplitude is just short of clipping. It means you'll have to experiment a little, but that's the whole point of the exercise. With a bit of trial and error, you can get the distortion down to less than 0.03%...

Many of you will have seen the common phase-shift oscillator circuit, which looks similar to this. The problem with that circuit is that the output impedance is largely controlled by the collector resistor, which also determines the gain of the circuit.

This circuit has its output impedance set by the emitter resistor, but it can be set independently of the gain so you can vary it over a wide range and the circuit will still work. And work it does! Using a BC547 transistor, I've been able to get it to oscillate at a frequency of over 700kHz, in the low end of the AM band — which isn't bad for a one-transistor RC circuit.

In situations where the DC output voltage is important, you can set the output by adjusting the two 10kΩ base biasing resistors. Remember that there is a 0.6V drop from the base to the emitter and you can adjust it over a wide range as well.

The circuit operates over a fairly wide voltage range, with a low limit of about 6V; but this will be somewhat frequency dependent.

The 10uF electrolytic capacitor on the bias resistor junction ensures that there is no RF noise at this end of the circuit. Although I haven't tried it, you may be able to amplitude-modulate the RF by injecting an audio signal in at this point and dropping the 10uF capacitor to 10uF (0.01uF) — it may work, but I won't guarantee it.

As I mentioned earlier, this circuit should work with any transistor with a gain of at least 50.

PNP transistor?

If you like, you can also use this circuit with a PNP transistor such as a PN200 or a BC557. The only thing you have to do is swap the supply rails over, along with the polarity of the electrolytic. Note that the DC output will be 0.6V *above* half the supply rail, instead of below it when using the components specified.

For those who may not be too sure about this, the circuit for the PNP version is shown in Fig.5. It operates in exactly the same manner, but with reversed polarity.

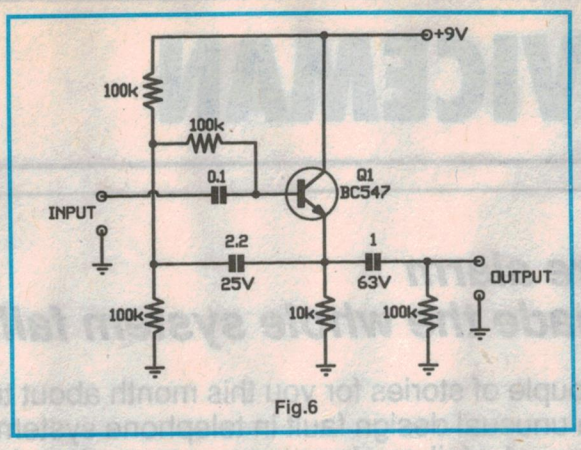


Fig.6

If you're trying to get the PNP version to oscillate at high frequencies, remember that the NPN BC547 has a higher Ft or 'top-end' frequency limit than the PNP equivalent. You'll most probably find that you'll end up with too little capacitance the higher you go, but there are better ways to make RF oscillators and we'll get to those in a coming issue.

Bootstrapping?

This unusual bit of electronic jargon is often associated with our next circuit, shown in Fig.6. Most audio transistor amplifiers have a medium-level input impedance and in most situations, this is fine. But when it comes to amplifying the signal say from a crystal radio set, which often has a very high output impedance, most transistor circuits won't work. But *this* one will.

It's commonly called a *bootstrapped emitter follower*. 'Emitter follower' because the output from the emitter 'follows' whatever the base is doing, apart from being 0.6V DC lower. The 'bootstrap' reference is best explained by going through the circuit.

In the standard emitter follower circuit (Fig.7), the input impedance (or the load seen by the preceding circuit) is largely determined by the base biasing resistors. Now while you can increase these up to 1MΩ or so, providing you change a few other components, this really only pushes the impedance up to around 500kΩ. That's because the preceeding circuit sees the two resistors as being in *parallel*, since there are two paths to the supply rails — one to ground and one to the positive rail.

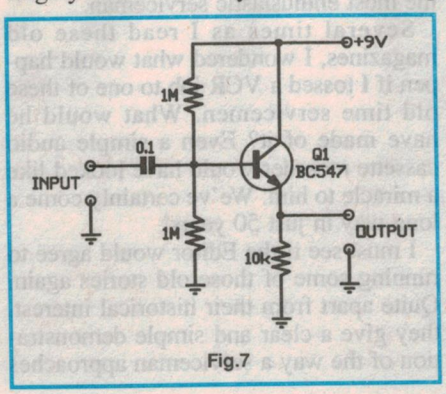


Fig.7

These days, there are devices called FETs which have input impedances in the order of megohms; but if you don't have one, then they're not much good.

The circuit in Fig.6 virtally eliminates the effect of these bias resistors, and pushes the input impedance up to a figure of the transistor's beta times the emitter resistor. If we assume that Q1 has a beta of 200, then the 10kΩ emitter resistor produces an input impedance of 2MΩ, even though the highest value resistor is only 100kΩ. So let's see how it works...

The DC biasing is set up by the three 100kΩ resistors — two forming the actual voltage divider, and the other providing the feed to the base of Q1. The input signal is coupled directly into the base via a 0.1uF capacitor. Now since this is essentially an emitter follower, the signal at the emitter is going to be only fractionally smaller in amplitude than that at the base — about 0.5% less, and in the same phase.

This signal at the emitter is coupled back to the divider resistor pair by the 2.2uF electrolytic capacitor. Now the interesting thing is that the 100kΩ feed resistor has virtually the same AC signal on both sides of it, which results in very little AC current flow. This effectively increases the AC impedance of the resistor, and lifts the circuit's input impedance — hence the phrase 'pulling it up by its bootstraps' which is where the term originates, in this case anyway.

From an AC input signal's point of view, the three bias resistors now appear to be 'not there'. So instead of the circuit having an input impedance of around 40kΩ, it is now closer to 2MΩ.

Even though this circuit doesn't amplify the signal, the output impedance is only 10kΩ which is ideal to feed into any ordinary transistor amp.

As with most things, there is a small down side with this circuit. In this case it does add some noise to the signal, but it is better than no signal at all.

Again, you can also use this circuit with a PNP transistor instead. Simply

Continued on page 62

THE SERVICEMAN

The fail-safe failure alarm that sometimes made the whole system fail!

Just for a change, I have a couple of stories for you this month about tracking down faults in valve equipment. One concerns an unusual design fault in telephone system equipment that used racks and racks of valves, which caused a failure alarm system to produce faults of its own. There's also a story about a strange intermittent in a modern solid state AM/FM radio, and another one about the way you can lead yourself astray, when you jump to the wrong initial conclusions about a fault's likely cause.

A month or so ago I was given a vast collection of old (and I mean really OLD!) copies of the forerunners of *Electronics Australia*. In fact, the magazines were so old that they were three titles back — not *EA*, not *R,TV&H* but the old original *Radio and Hobbies in Australia*!

The earliest edition in the collection was the February 1943 issue. It was naturally a wartime edition and much of the content was related to Army, Navy or Air Force matters.

As might be expected, the domestic content was concerned with keeping the 'home front' sets working, and the editor's leader tried to keep readers up to date with the then wartime supply position.

Other editorial comment in some of those early editions had a lot to say about the licensing of radio servicemen.

Yes, some servicemen were licensed to repair radio sets; the rest were 'manpowered' into factories or the armed forces. Times were pretty grim for a while.

Then after the war, things began to get back to normal and in 1946 'The Serviceman Who Tells' — this column under its original name — returned to these pages. In one way or another it's been here ever since!

I've read through 50 or more 'Serviceman' columns from that period, and have come to the conclusion that life must have been pretty dull for a radio tech in those days.

The 50 columns covered nearly 200 separate stories, and 170 of them were about four or five valve radios. There were a few about public address amplifiers, some about irons and toasters, and no less than four complete columns given over to an accountant, on the subject of bookkeeping for the small business.

I have to admit that some of the radio faults would have taxed the skills of the best of today's technicians. But the thought of fixing nothing but five valve radios, day after day, would depress even the most enthusiastic serviceman.

Several times as I read these old magazines, I wondered what would happen if I tossed a VCR job to one of these old time servicemen. What would he have made of it? Even a simple audio cassette recorder would have looked like a miracle to him. We've certainly come a long way in just 50 years!

I must see if the Editor would agree to running some of those old stories again. Quite apart from their historical interest, they give a clear and simple demonstration of the way a serviceman approaches a job. In the meantime, I must get back to 1995 and put together an article for *this* month's magazine...

Valves in bulk

Our first story this month comes from prolific contributor Alan Leitch. If you remember, Alan writes about telephone and security systems, and this time we have a tale of woe from the first of these. He tells it thus...

About 30 years ago, before semiconductors were in general use in telecommunications equipment, there were a few large electronic systems which used great quantities of thermionic valves. One of these was a 960-channel coaxial cable carrier system, which had a valve complement of about 3000 EF91 pentodes and consequently it was not very reliable by today's standards.

In an effort to achieve some degree of reliability, the cathode current of each of the valves was monitored by a metering circuit and the percentage variation (PV) was manually recorded on test sheets. It was soul destroying and repetitive, but a very necessary task.

Now while this testing could detect valves which were falling in emission, it did not take into account the abrupt failure of a valve. To overcome this problem an alarm circuit which monitored the screen potential of each of the valves was incorporated into the system design. This simple circuit employed a neon indicator (NE2) connected between the screen of the valve and a reference potential, fed via the primary winding of a pulse transformer.

If a valve failed, its screen potential would rise and eventually the NE2 would fire when the difference between the

screen and reference potentials approached 90 volts. The pulse transformer coupled the current pulse of about 2mA to the grid of a gas triode, which also served as a rack alarm indicator. An audible alarm was initiated by a relay in the anode circuit of the gas triode.

The technician who responded to the alarm would identify the rack of equipment from the glowing gas triode, and the faulty valve in that rack by the glow of its NE2. This alarm system worked well if valve failure was abrupt, but occasionally part of the system would fail and there would be no alarm or other indication.

The system would become very noisy and whole supergroups of 60 channels would be unusable. Occasionally, even the entire system would fail. Under this condition the only way to identify the source of the noise was to connect a noisy channel to a monitoring amplifier and rush around the racks of equipment, shorting plug in hand, to short out signal paths until the noise disappeared.

The rack of noisy equipment could be identified in a few minutes and this rack isolated. Provided that the faulty equipment was not high up in the architecture of the system, service would be restored to most of the system and the noise source tracked down in a less panicky situation.

After this type of fault had occurred a few times, a thorough investigation was initiated and the culprit was identified as the valve failure alarm circuit itself. In the true Edsel Murphy tradition of electronic faults, the edict that failsafe circuits will destroy other circuits was justified!

Analysis of the valve failure alarm circuit revealed that under certain conditions of marginal low emission, the screen resistor, the screen bypass capacitor and the NE2 formed a relaxation oscillator which modulated the screen voltage with a sawtooth waveform.

The current in the NE2 was insufficient to give a visible glow and would not fire the gas triode. As the NE2 was not fully ionised, wide band noise was also generated and this along with the harmonics of the sawtooth wave were injected into the signal path.

In multichannel analog systems the individual channel levels are low, so that linearity can be maintained when all of the channels are combined on a single bearer circuit. These levels are specified by CCITT convention and are typically -35dBm at the supergroup (60 channel) stage.

The noise floor in a valve system is very high by today's standards. The shot noise generated by thermionic emission and the thermal noise of the resistors combine to degrade the SNR (signal to noise ratio) *of the system to about 65dB.*

When the noise generated by the NE2 was injected into the signal path, it was several times greater than the normal signal levels and the system was was driven into nonlinearity. The result was catastrophic failure, as the high level noise and harmonic distortion pervaded the entire system.

Several attempts to modify the low emission alarm circuit were unsuccessful, and the problem was never resolved. It remained until the system was eventually decommissioned and scrapped.

Thanks, Alan. That was quite interesting. I always knew that valves were unreliable, but I didn't realise that they could fail in just so many different ways. In a five valve radio they would either go or not go, but as you have pointed out, in critical and large scale usage, failures can take many forms.

Persistent short

While we are on the subject of valve failure, here's a story that illustrates yet another kind of trouble. It's from Peter Laughton of Albion Park in NSW. Peter has appeared in these pages before, but at that time he was talking about country power supplies. This time he's in his own office...

I have an old Stromberg-Carlson valve radio on my desk here at work. It's quite a conversation piece, as well as being useful for listening to the news etc. But it has an interesting 'intermittent' fault.

From a cold switch-on, it takes longer and longer to come on. The time increases from an original 10 seconds or so up to two or three minutes. Eventually it doesn't come on at all. The valves are glowing, high tension is OK. Valve voltages are all OK, but it just won't work.

Then one day I accidentally brushed the tuning capacitor and got a shock that threw my hand into the side of the cabinet. It turned out that the converter valve had developed an internal short from the anode to grid.

As it's my only radio and replacement valves are now very hard to come by, I though I might be able to blast the short away with some voltage. At first I tried 12 volts, but that did nothing. Then I tried a capacitor charged up to 500 volts, using a megger. There was a flash from inside the valve and the short was gone.

"Beauty!", I thought, and the radio worked OK for a couple of months — when the performance had to be repeated. I imagine that the effect is due to metal ion migration within the valve, and the high voltage burp destroys the metallic layer.

Unfortunately, after a few months it comes back and the process has to be repeated. I don't know how long the valve will suffer such treatment, but readers may have their own theories.

On the subject of repairing old radios, there must be people out there who service the old valve equipment and they should have stories to tell the modern generation of service people. My own knowledge about valve circuits and servicing has faded rather too quickly. I suppose that is because I don't have a lot of contact with such equipment these days.

This was once our 'bread and butter' and I, for one, would like to be reminded of the old days.

So there it is, another form of valve failure that fortunately wasn't all that common, but still occurred often enough to be a nuisance. Thanks for that story Peter, though I'm not sure that I should have used it. The subject is more appropriate for Peter Lankshear's 'Vintage Radio' column...

Come to think about it, a lot of what you ask for in your last paragraph does appear in 'Vintage Radio'. So perhaps my idea of repeating some of the old *R&H* stories is not such a good one after all. What do readers think? Is there enough interest to supplement 'Vintage Radio' with a few different stories in these pages, or not?

Anyway, thanks for your story Peter. I've still got a couple more of your tales put away for a later date.

Radio that died

Now we come to a more up-to-date story, from Roger Valmardre of Glenella in Queensland. We haven't heard from Roger before but if this story is any indication, we will have more tales from him in future.

In this story Roger writes about a radio repair, but one significantly different to the one in Peter Laughton's story. This is a modern AM-FM, fully solid state receiver. Here's what Roger has to say:

Don't we all love those jobs where the fault is accurately described, the appliance is easy to dismantle, its innards are well laid out, the remedy almost suggests itself, and the owner has it back the next day? Well, this wasn't one of them!

It started with a request from one of my workmates, on behalf of a mutual friend, to have a look at his portable three-in-one and see if I could do anything with it. When I asked what the problem was, I was told that the FM radio didn't work.

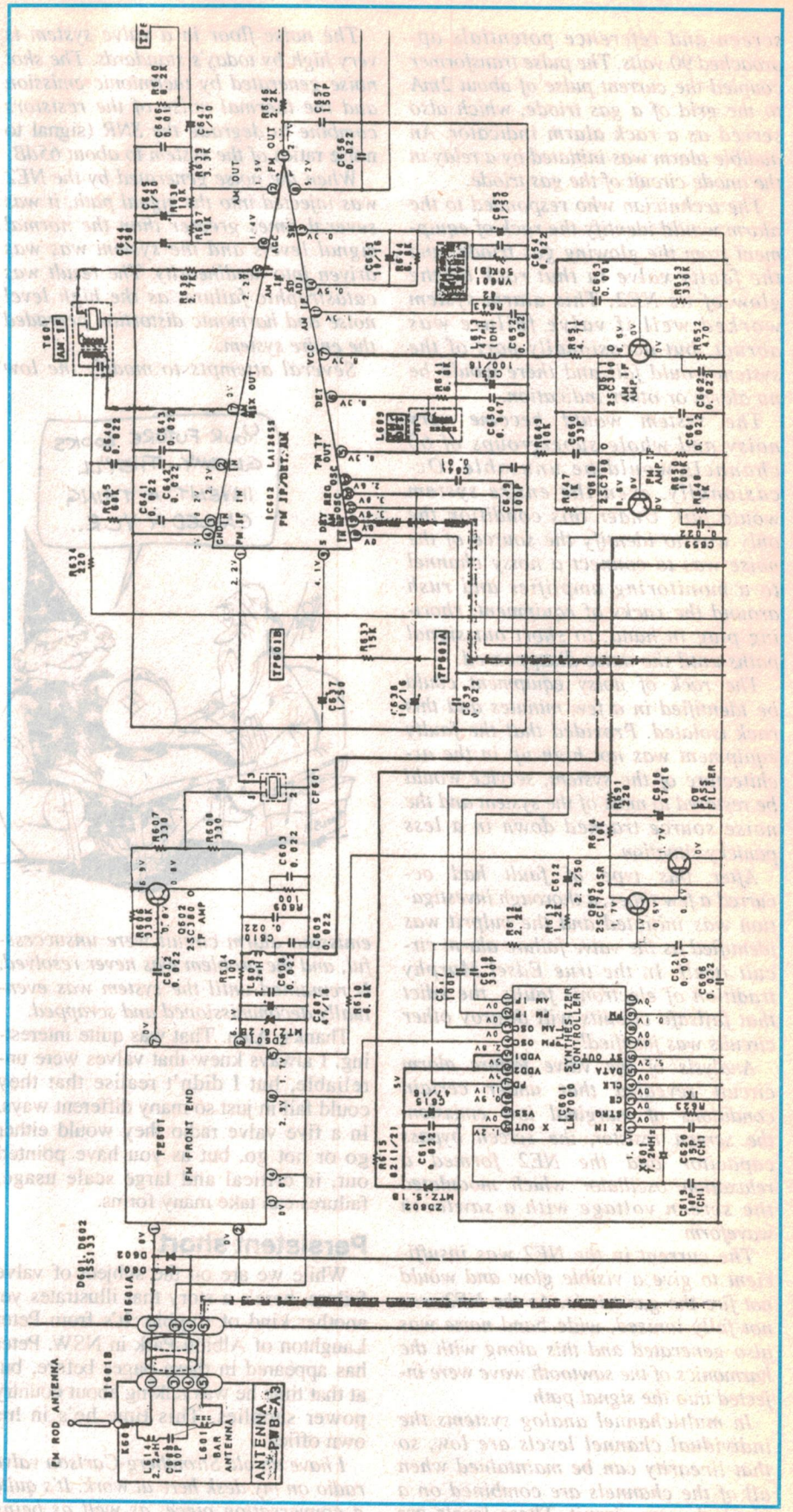
That didn't sound like too much of a hassle, so I cheerfully agreed to have a go. The owner apparently had already looked inside and promptly developed a severe case of 'chip shock' (a state of panic caused by seeing a large number of ICs each with more than fourteen legs), and decided to re-assemble the unit. This was quite a sensible decision, as it happened.

'It' turned out to be a Sharp GX-CD75X, and as well as the AM-FM tuner there was a CD player, twin cassette decks and an amp with a three band 'graphic equalizer'. Both the tuner and the CD player had attractive LCD displays and there was also the facility for IR remote control. In other words, everything that opens and shuts — including the 'optional' battery compartment corrosion!

No wonder the owner decided to err on the side of caution!

Upon firing it up, however, the FM section seemed to be doing its job with no noticeable fuss; listening to one of the local FM stations sounded pleasant enough. This is just what every electronics enthusiast loves — a fault that decides to play hide and seek!

As I was beginning to get a 'snack attack', I decided to take the opportunity to let it run and see what it would do while I attended to more important matters. About 30 minutes later, the sound started to fade out and soon there was nothing to be heard. Hmmm... was it a heat sensitive fault?



The front end circuitry of a Sharp GX-CD75X portable three in one, which forms the subject of our story from Roger Valmardre. It turned out to have a very tricky intermittent fault, which took quite a bit of finding...

The AM tuner was likewise mute, but everything else worked perfectly. To revive it, all I had to do was disconnect the power for half an hour or so, whereupon it would go merrily on its way for about 20 minutes before flaking out again.

Fortunately, disembowelling the unit was easier than it first appeared, so before long I was bravely (read naively!) tracing whatever signal I could find around the tuner/amp/cassette deck board without a circuit diagram, pausing to freeze the occasional component to see if the fault would 'hide' again.

No prizes for guessing how far I got using that approach! No matter what I did, the signal would come and go (mostly the latter) without any obvious cause whatsoever. (As we all know, there are many circuits which do fail in a fairly predictable way; assuming that this was one of them was my second mistake!)

Obtaining a 'circus' diagram to work from made matters much easier; everything seemed to point to IC602, an FM IF/detector and AM IF circuit. When all was functioning, signals went into and out of said IC; when the fault appeared, signals went in, but nothing came out again. What's more, most of the DC voltages on the chip (save for the power supply rails) seemed to change a little when the fault appeared.

"Gotcha!" I thought — a faulty IC! One of my mates has a saying applicable to this situation: the chances of the IC being faulty are inversely proportional to the number of pins it has.

Be that as it may, I felt sure enough about this one to go out and order a replacement. And when I fitted the chip, the beast worked; quite a fitting way to conclude an evenings labour! On went the case and all that was left to do was to give it a good long run prior to handing it back.

It worked faultlessly, for about three hours! (Isn't it funny how intermittents seem to know when everything has been re-assembled?) At least I hadn't returned it to the owner; he would've been just as 'delighted' as I was.

Resisting the temptation to take the doggone monstrosity outside and reverse the car over it, I took it back to the work bench.

Time for some serious head scratching! This time, ALL the voltages around the chip were written down before and after the fault appeared, and several components were lifted to isolate the pins one by one. (Has anyone out there spotted the culprit yet?)

Nothing made any real difference until I disconnected T601, an AM IF transformer and ceramic filter assembly. With it in circuit, the FM stage refused to work and all DC voltages were slightly low. With it out of circuit, the FM was perfect, and all DC voltages were back to normal.

As it turned out, the ceramic filter had gone intermittently leaky; I guessed that the leakage, small as it was, proved enough to muck up the internal biasing of the chip. Anyhow, all it took was to solder a small ceramic capacitor in series with pin 15 of the IC (thus blocking any direct current flow) and the problem vanished.

The same would probably have occurred with the original IC, had I

bothered to refit it. When asked about this, my learned friend said he'd seen it happen quite often; even low voltage DC imposed across ceramic filters was enough to make them fail. That's another one for the file that I certainly had not struck before.

All that remained was to give it a good run (for several days this time, just to be certain!) then return it to the grateful owner. I was rather grateful too; at one stage it seemed as if the thing would never get fixed! But there was, as usual, one consolation — at least it was a useful learning experience!

You can say that again, Roger. And thanks for the story.

Ceramic filters have been a great boon to manufacturers — they save dozens of discrete parts and make cheaper sets more easily. But I don't know that they make for more reliable sets.

I have often come across weird faults in television sets, which were finally tracked down to a dodgy SAW filter (essentially just a ceramic filter but a bit more complicated) in the IF strip. I didn't check for a DC component on the filter, but if it spoils a radio unit, then it would likely do the same to a TV version. That's something I'll watch for next time I see a queer picture.

Thanks again, Roger. I will look forward to another story in the not so distant future.

Wrong mind-set...

Now for another tale of misery from my own workshop.

In the February edition, I told the horrific story of my battles with a Sanyo colour TV. It was a model CTP 6631, to be exact, and to end the story I expressed the hope that I would never see it again.

Well, to be honest I have not seen IT again. But the very next day after that one went home, another of same species turned up on my bench! I just about hit the roof, and demanded of all within earshot "Who brought this (expletive deleted) thing back?"

As it turned out, it wasn't the same one back again but from another customer altogether. It was suffering from the same general symptoms, but I couldn't believe that it would prove to be the same fault. However, with my recent experiences still fresh in mind, there was no way this one would take as long to fix as the last one did. Or so I thought!

On the bench the set was quite dead. There was no trace of picture and only the faintest trace of hiss from the loudspeaker.

When faced with a dead set, there are a few routine tests one should make to determine which direction subsequent investigations should take. One checks

the AC fuse, the DC fuse and the line output transistor, in that order. These are the three most common indicators of trouble and will often save hours of fruitless wandering around the chassis, if the results of the tests are properly interpreted.

From that comment, you will probably guess that this story is about 'fruitless wanderings', and you would be quite right. It's a revelation about my habit of getting into a mind-set and refusing to consider any solution other than the one I have first decided on.

In this case I checked the fuses and found them intact. Likewise the line output transistor showed no sign of leakage or short circuit, the most likely form of trouble in that department. Of course, the transistor could have been open circuit, but that is a fault that would show up in later tests.

These tests are about all one can do with the set switched off. From here on needs a bit of power in the circuits, preferably supplied via an isolation transformer. Which I was soon able to supply.

With the power on, I found that the set wasn't quite dead, as the faint hissing in the speaker had proved. There was, in fact, about 25V on the 115V rail and two or three volts on the 18V rail.

The fact that there was voltage on the main rail suggested to me that there was a near-short somewhere along that route. In the past I have struck transistors that check OK on a meter, but go leaky with full voltage applied. It looked as though something of this type might be responsible for the present problem.

Of all the likely sources of excess current drain, the line output transistor is first choice.

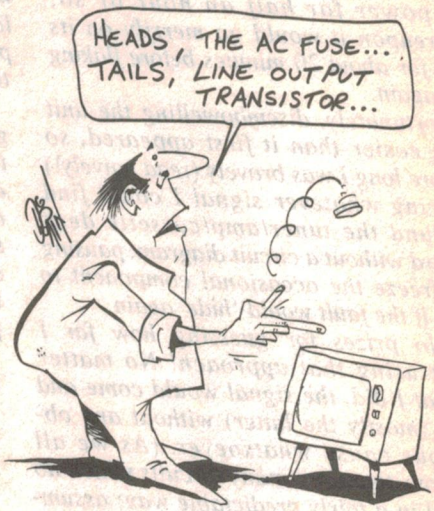
Next is the vertical output amplifier, and finally the audio amp.

These are the only parts of the set with high current demand — most other components are fed through relatively high impedance sources.

With this in mind, I set about finding some part of the set that was drawing excess current. It never entered my head that the problem might be with the power supply itself.

I won't bore you with the details of how I checked everything I could think of in the line, vertical and audio stages. Sufficient to say that I found nothing wrong anywhere. I just couldn't believe it!

Finally, I concocted two external supplies, one of 110 volts and one of 18 volts. When I connected these to the set, it started up and ran perfectly, with not a trace of distortion attributable to an overload condition. I had spent nearly half a day searching for a fault that didn't exist...



Or at least, it didn't exist in the places I was searching!

Even when confronted with the evidence, I still couldn't bring myself to acknowledge the obvious answer — that the power supply was playing up. The power supply was running and it was a simple and totally self-contained circuit. As I read the symptoms, the problem was excess load somewhere in the set proper and the power supply had shut down in sympathy.

But ultimately, I had to accept the fact that the supply was faulty, and that I would have to find the solution on the hot side of the chopper transformer. Which is exactly what I did.

Not that it was as easy as all that. I had to check everything from the transformer back towards the mains input. I was getting more and more frustrated when I finally reached D305, an 8V zener on the emitter of the error detector, Q301. It measured about 50Ω both ways! A new zener put the set back into first class order.

I have told this story against myself not as a brilliant piece of electronic detective work, but as an example of how one should not to get into a mind-set that stops you from examining other possible (even if unlikely) solutions. It will save you a lot of time.

That's it for this month. I'll be back with more contributors' stories next time. ❖

ELECTRONICS AUSTRALIA'S READER INFORMATION SERVICE COMPUTER BULLETIN BOARD

As part of its service to readers, *Electronics Australia* operates a Reader Information Service Bulletin Board System (BBS). This makes available a wide range of useful information, for convenient access and rapid downloading by readers with a personal computer and modem (we know that many readers have these facilities, nowadays).

Here's an idea of what's currently available on the BBS:

- Software needed for recent PC-based EA construction projects
- Project index files for EA and ETI construction projects
- Recent notes and errata
- Useful public domain and 'shareware' software for electronics and amateur radio applications
- General interest shareware utilities, such as the compression and decompression utilities used for faster file transfer.

The *Electronics Australia* Reader Information Service BBS is ANSI-compatible and is currently operational for virtually 24 hours each day, seven days a week, on (02) 353 0627. Your modem can be set to any standard speed from 300 to 28,800b/s full duplex, with a data format of '8-N-1' (eight data bits, no parity and one stop bit).

We're planning to increase the range of facilities available on the BBS soon, by adding such things as a discussion forum and a more convenient way for readers to send us 'Letters to the Editor' and contributions to columns like Forum and Information Centre...

So call up the *Electronics Australia* BBS and take advantage of its facilities — there is no cost for accessing the system itself, which is provided purely as a service for our readers. Your only outlay will be the usual cost for a phone call.

Note that for those readers without a modem, we can still supply project software and/or index files for $5.00 if you send us a formatted high density 3.5" or 5.25" floppy disk.

Mini Construction Project:

CRYSTAL-LOCKED 5MHZ RECEIVER FOR VNG

Here's the design for a low cost dedicated receiver for the 5MHz transmissions of Australian Time and Frequency station VNG. It is based on the direct-conversion principle, which allows the local oscillator to be used as a secondary frequency transfer standard.

by DREW DIAMOND, VK3XU

Radio station VNG at Llandilo, NSW, broadcasts on 2.5, 5.0, 8.638, 12.984 and 16.000MHz to provide a valuable time and frequency standard service. These signals may be tuned-in on an ordinary shortwave or HF receiver.

To check and adjust the time-base (TB) of an electronic counter for instance, we could tune to the 5.000MHz signal (assuming good propagation for the time of day) then couple a signal from the counter into the receiver. If the counter TB is harmonically related to 5MHz then a 'beat' should be observed on the receiver. The counter may now be adjusted for 'zero-beat' with the standard signal.

This method will give pretty good accuracy, to within a few hertz — which is probably sufficient for most ordinary practical purposes. My term 'pretty good accuracy' refers to the method just described, not that of the VNG carrier frequency, which is specified as one part in 10^7 as received.

Here are details of a simple dedicated 5MHz receiver designed to receive the VNG signals, which potentially offers significantly improved frequency accuracy over ordinary methods. Being a direct conversion job, the local crystal oscillator (LO) runs on exactly 5MHz, so the LO itself may also be used as the base for a workable secondary frequency transfer standard. When the signal is sufficiently strong, time and other announcements will be heard.

The LO is adjustable to within one or two hertz of 5.000MHz using a LED indicator connected at the audio output, which will vary in intensity if not at zero beat.

Should the station fade out and become inaudible, provided that the crystal has been maintaining zero beat and the ambient temperature remains fairly stable, it will continue to supply our 5.000MHz local reference.

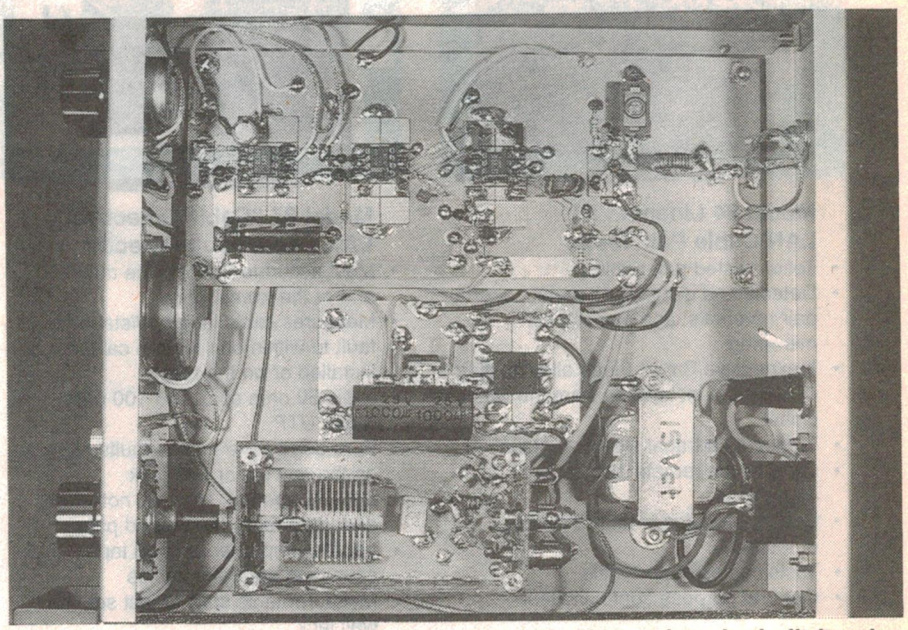
The circuit

The circuit is based closely on the DC91 80-metre receiver of a few years ago (Ref.1). That set uses an MFE131 dual-gate FET for the RF amplifier. However, these devices have become scarce, so the popular BF981 has been substituted here. About 15dB of gain is provided. The signal is then applied to the input port of the NE602AN balanced mixer chip, and LO at 5MHz is injected into the oscillator port at pin 6.

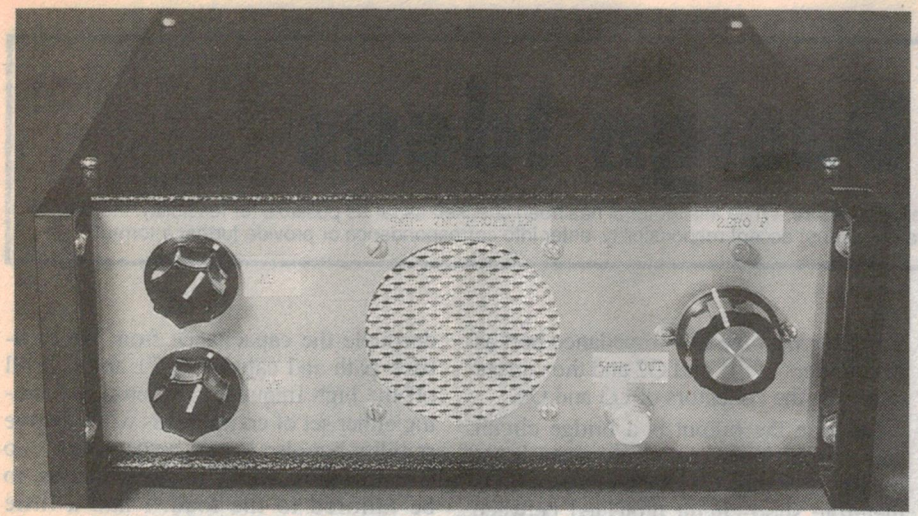
Normally, for a simple receiver, we would use the internal transistor provided in the '602 for the LO. However, because the LO and input frequency are the same, a DC receiver with an RF amplifier is rather prone to pickup of its own LO, which may cause blocking of the RF amplifier.

In this application the oscillator is a discrete shielded assembly with its own set of components. The variable capacitor in series with the crystal is adjusted so that oscillation is obtained on exactly 5.000MHz.

The input signal is 'directly converted' to audio frequency, which appears at pins 4 and 5 of the '602 product detector. A ubiquitous '741 op-amp and '386 power amplifier raise the detected signal to loudspeaker level. Low frequency audio response is such that the burble near zero beat may be heard through the speaker, and sub-audible frequencies observed as a 'winking' of the LED connected at the output. When the LO is at



As you can see from this photo inside the author's receiver, he built it using single sided unetched PCB, with small pieces used to mount each IC. The oscillator is built in a shield box made from unetched PCB laminate.



The author built his receiver in a small rack-type case. The inbuilt speaker is used as an audible guide to tuning, while the LED allows you to fine tune when the beat note falls below audibility.

zero beat the LED emits nearly constant intensity, and the AM speech announcements will be tonally correct.

Construction

The set may be housed in a suitably sized metal box. Power supply requirement is nominally 12V DC, although satisfactory operation down to about 8V is easily possible. Current demand is about 20mA from a 12V supply, so battery or mains operation may be used asdesired.

The prototype is powered from the usual 15V/150mA transformer, bridge rectifier, 1000uF filter capacitor and 7812 regulator configuration. It is a good plan to have the set running continuously, where a mains supply is recommended. The supply may be internal or external to suit requirements (but see below).

A main circuit board size of about 80 x 190mm is suggested, although a smaller size should work if miniaturisation is desired, in which case battery operation, or external mains supply is recommended — crowding a mains supply into a small space is asking for hum and temperature drift problems.

Single-sided unetched printed board material was used for the prototype although, once again, size may be reduced by having some components, (say the RF amp and product detector) on one side of a double-sided board, and the AF amp on the opposite side. The BF981 and the three socketed IC's are mounted upon small substrate boards, which may be soldered or glued 'pad-board' style onto the main board as shown. Any other construction method should be satisfactory, provided that plenty of circuit board ground conductor is preserved, and component leads are kept reasonably short.

As mentioned, the '602 has an internal oscillator transistor. However, in this instance a separate shielded assembly is an essential measure to provide the necessary isolation of the oscillator signal from the receiver's input. The oscillator and reference output buffer amp are housed in a home-made printed circuit box measuring 90 x 45 x 40mm (L x W x

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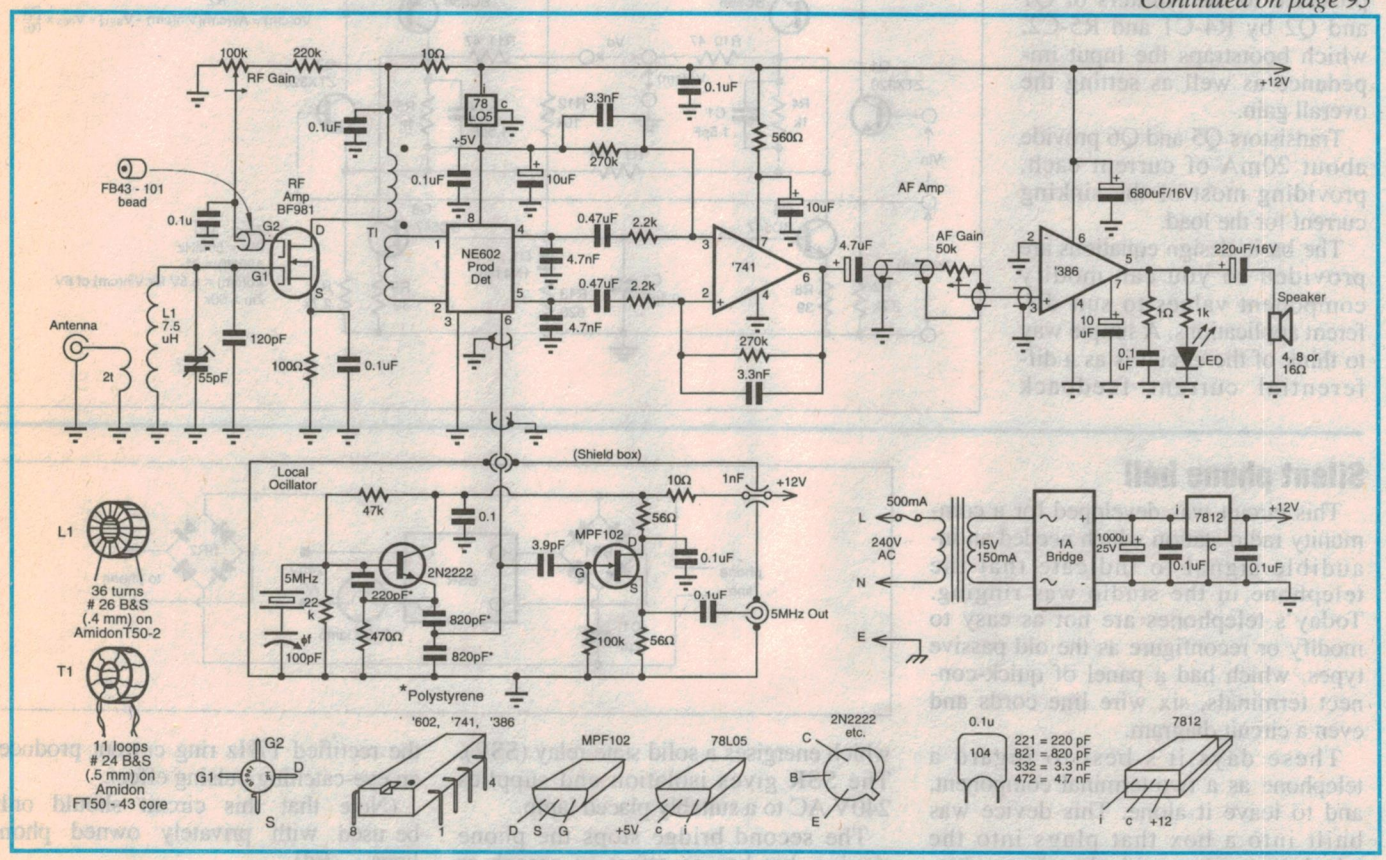


As you can see from the schematic, the receiver circuitry is fairly straightforward. A dual gate MOSFET is used as an RF amplifier, ahead of an NE602 chip used as the mixer.

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide further information.

Wideband current feedback amplifier

Current feedback amplifiers usually have a wide bandwidth, but are also rather expensive and have a fairly low maximum voltage (e.g., OPA660). This roll-your-own design uses discrete components and has a good gain and bandwidth, while providing greater power and voltage range than many ICs.

The amplifier has a differential gain of 20 and a bandwidth of about 50MHz, giving it a total gain bandwidth product of 1GHz, which is pretty good considering the transistors are nothing special. It also provides an output swing of 18Vp-p from a +12V supply.

Transistors Q1 and Q2 form a differential pair which drive transistors Q3 and Q4. Feedback is provided to the emitters of Q1 and Q2 by R4-C1 and R5-C2, which bootstraps the input impedance as well as setting the overall gain.

Transistors Q5 and Q6 provide about 20mA of current each, providing most of the sinking current for the load.

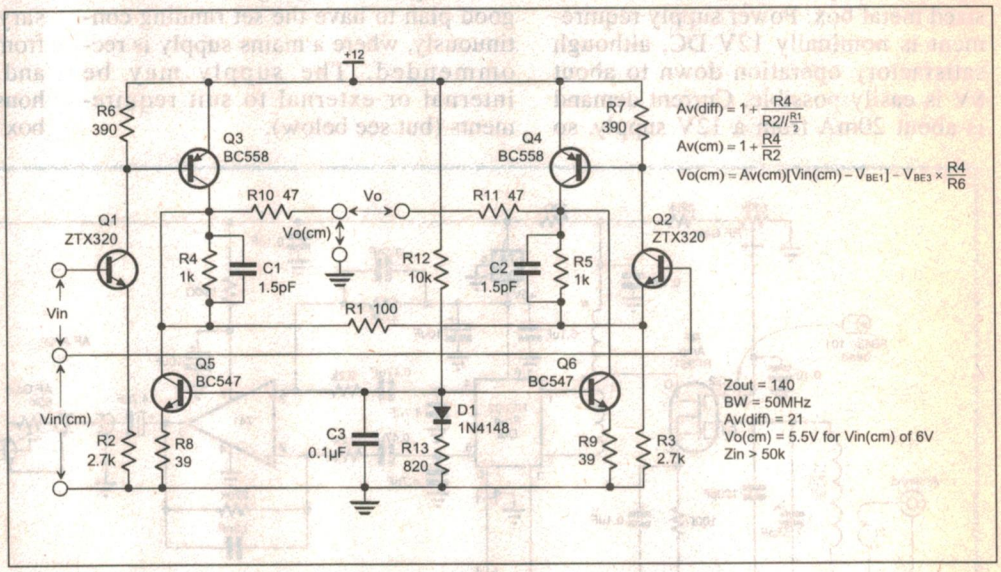
The basic design equations are provided so you can modify component values to suit different applications. A simple way to think of the circuit is as a differential current feedback amplifier with the low impedance port as the emitters of Q1 and Q2 and the current output as the collectors of Q3 and Q4.

Because the output is a bridge circuit and the maximum positive current is set by R4, R5 and Q5, Q6, the output is therefore short-circuit protected between resistors R10 and R11. Resistors R2 and R3 can be replaced by current sources to reduce the common mode gain. The main criterion is to balance the currents at the emitters of Q1 and Q2, to give a common mode output voltage of Vcc/2.

Care should be taken when driving capacitive loads as the circuit can oscillate. Output resistors R10 and R11 help decouple the capacitance from the feedback path and capacitors C1 and C2 roll off the high frequency response. Increasing either set of components will improve stability but also lower the bandwidth, so compensation needs, in special cases, to be tailored to the load. I had a little trouble measuring the output with my scope because it didn't like driving the ground lead.

Best results are obtained using two x10 probes connected differentially, and the ground leads connected to the negative supply.

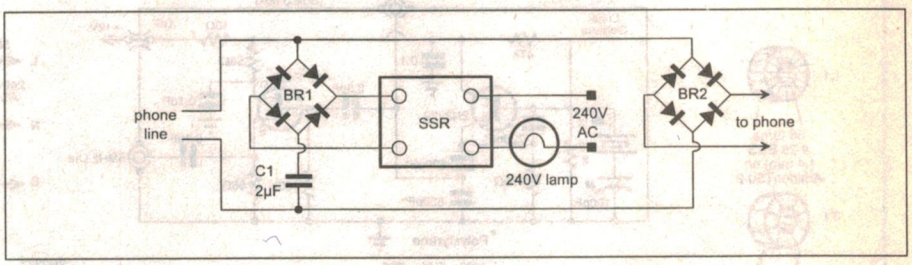
Mark O'Farrell
Yagoona, NSW. **$45**



Silent phone bell

This circuit was developed for a community radio station which needed an inaudible signal to indicate that the telephone in the studio was ringing. Today's telephones are not as easy to modify or reconfigure as the old passive types, which had a panel of quick-connect terminals, six wire line cords and even a circuit diagram.

These days it's best to regard a telephone as a two-terminal component, and to leave it alone. This device was built into a box that plugs into the telephone socket, with the phone plugging into a socket on the box. The incoming ring voltage is rectified by bridge 1, which energises a solid state relay (SSR). The SSR gives isolation and supplies 240V AC to a suitably placed lamp.



The second bridge stops the phone ringing, but has no effect on speech or tone transmission. Because an SSR has a zero voltage switch-on and switch-off, the rectified 17Hz ring current produces an eye-catching pulsing effect.

(Note that this circuit should only be used with privately owned phone lines — Ed)

Graham Leadbeater,
Heather Grove, Vic. **$30**

Water purity tester

This device is essentially an AC ohmmeter and was built to measure the purity of rainwater. Dissolved ionised salts in the water cause it to conduct electricity, and most of the common salts give a conductivity directly proportional to concentration. Those that don't can be ignored.

To measure salt concentration, two electrodes are placed in the substance being tested. The electrodes must be rigid and supported so their physical relationship to each other doesn't vary. Also they must be made of a durable material such as stainless steel or carbon.

Stainless steel welding rod about 4mm diameter and about 100mm long is suitable. Carbon rods with solderable metal caps can be obtained from new D cells (zinc-carbon, not alkaline cells). Leads, which need to be insulated and fairly durable, are soldered to the probes.

Stainless steel rods can be sharpened for digging into soil or mixtures. Carbon is best for immersing into a solution. Fig.1 shows a photo of the electrode assembly used with the prototype, and consists of two carbon rods supported in an epoxy glue base.

The electronics is not critical and is powered from a 6.3V 1A transformer. I housed everything in a 200 x 150 x 75mm plastic junction box. The readout is a 1mA meter of any shape or size.

The amplifier contains an N-channel FET (virtually any type will do), an NPN transistor and a PNP feedback stage. Resistor R11 sets the FET operating conditions and could be a resistor and a trimpot in series. In operation, the electrodes are immersed in the solution being tested. The AC current through the electrodes passes through the resistor selected by SW1 (range switch). The resulting voltage appears across RV2 which supplies a portion to the gate of FET Q1. The FET drives Q2, which actuates the meter. The function of RV2 is to adjust the amplifier sensitivity for the electrode's geometrical characteristics.

Fig.1

To calibrate the instrument you need about half to one litre of calibration solution. A solution of one in 1000 of sodium chloride (table salt) will give full scale deflection on the x100 range. Weigh a little under one gram of salt (say 0.925 grams) very accurately, and then fully dissolve it in 1000 times this weight (ie 925ml or 0.925 litre) of rainwater or demineralised water.

Then:

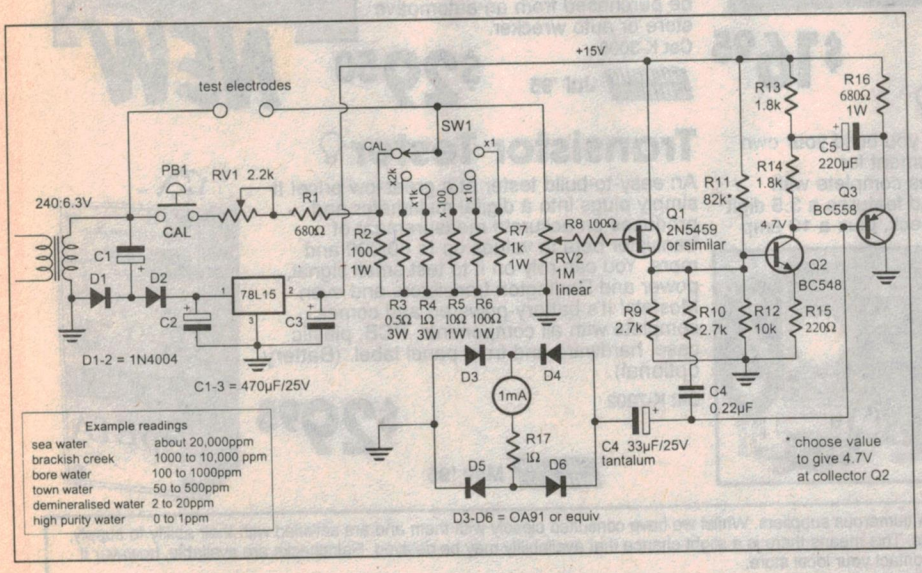
(1) Place the electrodes in the test solution, holding them away from the sides.
(2) Set the range switch to x100 and adjust RV2 to give full scale on the meter.
(3) Unplug the electrodes, or withdraw them from the solution, and set SW1 to the CAL position.
(4) Press PB1 and adjust RV1 to give half scale on the meter. Lightly glue the wiper of RV1 in place to give a permanent calibration setting for the electrodes.

To use the instrument, set the range to CAL, press the pushbutton and adjust RV2 to give half scale deflection on the meter. Then connect the electrodes to the instrument and place them into the liquid being tested. Select a range until a suitable reading is obtained. The reading in parts per million (ppm) equals the meter reading multiplied by the range setting.

The reading is a measurement of equivalent parts per million sodium chloride. That is, all salts (of calcium, sodium, potassium, iron magnesium and so on) are lumped together and read as though their contribution to the impurity is expressed as the equivalent effect of table salt.

It will not show organic materials such as sugar or starch. A list of some typical figures is given with the circuit diagram. Providing the temperature during testing is about the same as the temperature during calibration, this instrument will perform quite accurately.

Brian Byrne,
Indooroopilly, Qld. **$55**

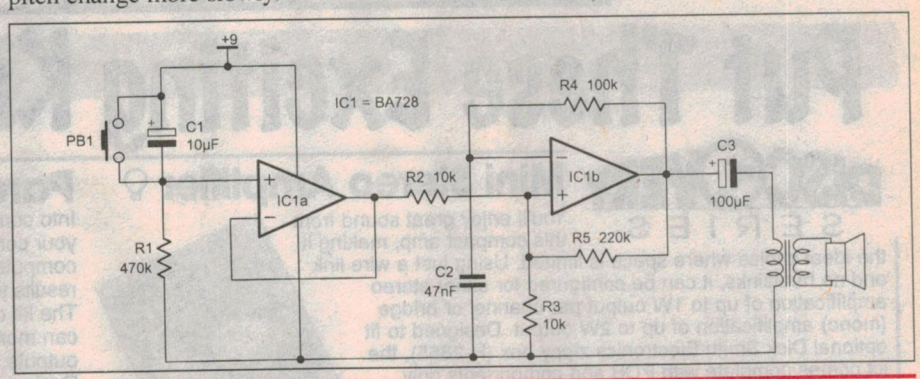


Falling bomb simulator

This circuit gives the sound effect of a falling bomb. Op-amp IC1a is a buffer and IC1b is an astable multivibrator. Capacitor C1 and R1 are the timing components that determine the length of the tone. Increasing their values makes the pitch change more slowly.

When PB1 is pressed, the output of IC1a becomes positive, decreasing as C1 charges via R1. This falling voltage is applied to the +ve input of IC1b, which controls the frequency of the astable multivibrator. The speaker is driven by a small transformer, which is DC isolated from the output of IC1b by capacitor C3.

Conan Sumera,
Jesmond, NSW. **$30**



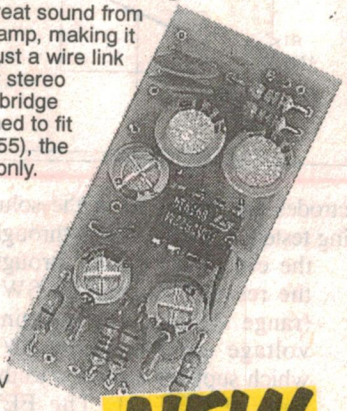
DICK SMITH ELECTRONICS

Put These Exciting Kits To Use!

DISCOVERY SERIES

Mini Stereo Amplifier

You'll enjoy great sound from this compact amp, making it the ideal choice where space is limited. Using just a wire link and no heatsinks, it can be configured for either stereo amplification of up to 1W output per channel or bridge (mono) amplification of up to 2W output. Designed to fit optional Dick Smith Electronics zippy box (H-2855), the kit comes complete with PCB and components only.



Specifications

Power supply:	1.8 - 15V
Frequency response	
Stereo:	50Hz - 130kHz into 8 ohms
Bridge (mono):	70kHz - 20Hz into 8 ohms
Power Output	
Stereo:	1W/ch into 8 ohm at Vcc=9V
Bridge (mono):	2W into 6 ohm at Vcc =12V
Sensitivity	
Stereo:	30mV input for 1W/ch at Vcc = 9V
Bridge (mono):	80mV input for 2W output at Vcc =12V

Cat K-2806

EA Jul '95 * PCB's come silk-screened and solder masked!

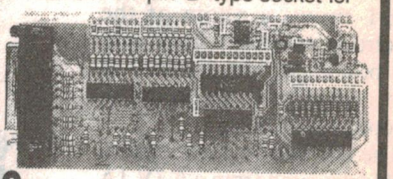
$12.95

NEW

Parallel Port Interface

Into computers? With this kit connected up to your centronics parallel printer port, your computer can sense data, process it and use the results to control relays, solenoids, motors etc! The kit operates via a 9V battery or DC supply, can monitor 10 analogue voltages, drive 8 digital outputs, and generate 2 variable voltages. Designed to fit the Dick Smith Electronics zippy box (H-2851), the kit includes sample programs that can be manipulated to suit your needs, PCB, components and 25-pin 'D' type socket for connection to parallel port.

Cat K-2805



$42.50 * Battery is optional.

EA Jun '95

1 Watt Trainer Amplifier

As the circuit diagram is printed on the circuit board, you'll find this kit very easy to assemble! Plus, it provides an easy-to-follow guide to how the circuit works! A 1-watt power amplifier, it can be used with your personal stereo, your personal CD player, or with your computer's CD-ROM. It uses low-cost components and is supplied in shortform with all components and silk-screened (colour-coded) PCB.

Specifications:

Supply:	12 Volts
Output:	1.13W into 8ohm
Sensitivity:	150mV for 1W (output into 8R)

Cat K-5605

SILICON CHIP Jun '95

$16.95

Electric Fence Controller

Prevent stray animals from wandering onto your property! Based on an automotive ignition coil, this low-cost kit is suitable for activating fence runs of up to 300 mtrs depending on conditions. It's supplied with all components, panel labels, PCB and hardware items such as banana sockets and battery terminal alligator clips. Other hardware items such as PVC tubing, end caps and 12V ignition coil are optional. Both the 90mm PVC tubing and end caps can be obtained from your local hardware store, while 12V ignition coil can be purchased from an automotive store or auto wrecker.

Cat K-3008

SILICON CHIP Jul '95

$29.50

NEW

Digital Multimeter

Learn the ins and outs of digital multimeters as you build your own low-cost model! An essential piece of test equipment for enthusiasts, trades people and schools, it comes complete with comprehensive assembly instruction manual and features a 3.5 digit LCD display, 19-ranges, diode and transistor check, plus a 10 amp current range. The kit comes complete with all components, PCB, hardware (including plastic case), display, test leads and battery.

Ranges:

DC Volts:	200mV, 2000mV, 20V, 200V, 1000V
AC Volts:	200V, 750V
DC Current:	200uA, 2000uA, 20mA, 200mA, 10A
Resistance:	200, 2000, 20K, 200K, 2000K

Cat K-1044

SILICON CHIP Jun '95

$29.95

Transistor Tester

An easy-to-build tester at a great low price! It simply plugs into a digital multimeter and produces an accurate measurement of transistor beta to values up to 50,000 and more. You can rely on it to test small signal, power and Darlington transistors and even Mosfets! It's battery-powered and comes complete with all components, PCB, plastic case, hardware and front panel label. (Battery optional).

Cat K-7202

$29.95

SILICON CHIP May '95

Availability: Our kits consist of many different parts from numerous suppliers. Whilst we have consulted closely with them and are satisfied with their ability to supply, sometimes problems can arise in obtaining all of the parts. This means there is a slight chance that availability may be delayed. Rainchecks are available, however if you'd like to check beforehand, please don't hesitate to contact your local store.

You'll Find Just What You're Looking For!

3AG Fast Blow Ceramic Fuses

Suitable for applications where high current loads are expected. All feature a ceramic body construction that permits higher interrupting ratings and voltage ratings than glass* encapsulated fuses.

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10A 250VAC Cat P-8510
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20A 250VAC Cat P-8520

NEW $1.45

NEW WD-40

In a handy can size. Keep one in the car and one in the tool box! A favourite stand-by for drying out and protecting car ignition systems.
60g spray
Cat N-0105

$2.95

Rocker Switch SPST 12V DC 30 Amps

Ideal for use in cars, boats, model train sets, and any 12VDC circuit requiring heavy current handling. It features an internal 12V globe for illumination plus spade lugs for quick connection, and requires just one easy round hole to drill/punch (no hard to cut square or rectangular holes as required with normal rocker switches).
Cat P-7723

NEW $4.95

ULN2803A 8-Way Darlington Transistor Array, TTL Input

Eight NPN Darlington connected transistors makes this ideally suited for interfacing between low logic level digital circuitry, such as TTL and CMOS and the higher current and voltage requirements of lamps, relays, solenoids, or other similar loads for a broad range of computer, industrial and consumer applications. With open-collector outputs and clamping diodes for transient suppression.
Cat Z-6282

$4.95 NEW

Quick Crimps - Now In Packs Of 50!

Make fixing connectors and joining electrical cable fast and easy.

Cat H-3093 6.3mm Fem/Recept. Blue
Cat H-3094 6.3mm Fem/Recept. Red
Cat H-3087 4mm Male/Bullet Red
Cat H-3088 4mm Female/Bullet Red
Cat H-3090 4.8mm Female/Recept Red
Cat H-3092 6.3mm Female/Recept Red

$9.95 pkt

NEW

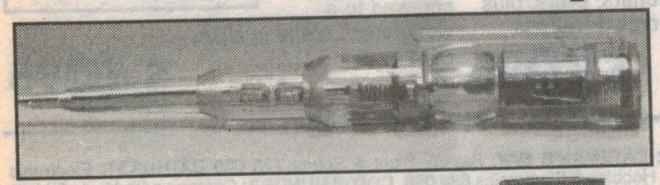
Quikcrimp

Voltage Tester With Screwdriver

NEW

Great for checking switches, batteries, bulbs, LEDs and more. Tests AC voltage - (by contact: 70- 250V max, non-contact 70-10KV AC) and has both continuity and battery test. Also includes a screwdriver and handy pocket clip.
Cat Q-1545

$9.50



CRC CO Contact Cleaner

This plastic-safe formula is a mild, yet effective solvent and is 100% CFC-Free. Comes in a 350g spray can. Flammable.
Cat N-1072

$19.95

SAVE $5

Solar NiCad Charger

NEW

Charges AA/AAA/C & D sized NiCad batteries!
Cat O-2005

$26.95

Stock Up On Our Handy New Tools!

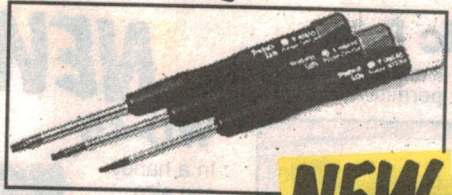
NEW

Multi-Purpose Scissors

With sharp blades and strong, comfortable handles, they're ideal for cutting thin plate, gasket material and cables.

Cat T-3279

$12.95



NEW

Torx Screwdriver Set

A handy set of 3 small Torx screwdrivers with tough nickel chrome molybdenum steel shafts, plus black oxided tips for greater durability. Sizes T6, T8, T10.

Cat T-6138

$16.95

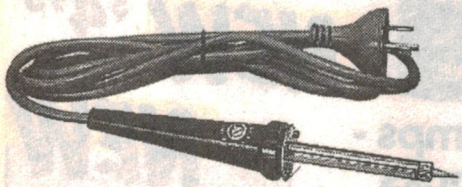
NEW

10-Piece Mini Spanner Set

Useful set of quality metric spanners covering most sizes between 4mm and 11mm. Suitable for light/medium duty uses.

Cat T-4550

$16.95



Varitemp Iron

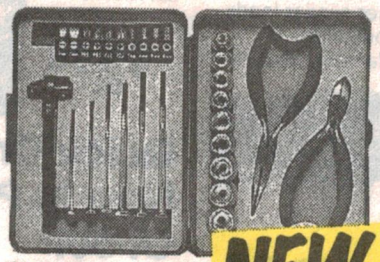
240-volt operation with 25-watt capacity makes the Varitemp a perfect choice as an all-round iron. The temperature control is conveniently placed on the handle and a great range of tips to suit most applications are available.

Cat T-1350

$39.95

Spare Tips:

Medium	Cat T-1351	
Large	Cat T-1352	**$7.95**
Conical	Cat T-1353	



NEW

28-Piece Compact Tool Kit

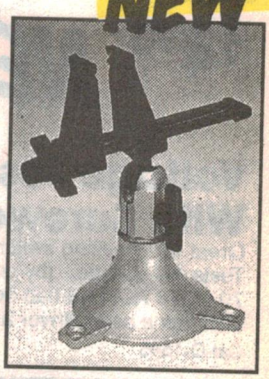
A convenient collection of tools complete with a foam-lined plastic storage case. Includes 9-piece Hex Nut drivers and quality reversible ratchet handle, 6-piece Jewellers screwdrivers, side-cutters, pliers, plus 10-piece assorted screwdriver bits.

Cat T-4610

$39.95

PanaVise Jr. PCB Vice

NEW



You'll find this vice useful when both hands are tied up working with PCBs. It holds the board firmly between adjustable tough plastic clamps, while the head assembly can be rotated and tilted. Features a solid diecast base, which can be screwed to a workbench. Made in USA.

Cat T-4740

$49.95

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Cat B-4701 **$9.95**

Climb Into The Cockpit... By Radio

NEW

Share the excitement of racing through the sky with this comprehensive guide to world-wide air traffic frequencies, terminology and procedures, using your scanner.

Cat B-4090 **$24.95**

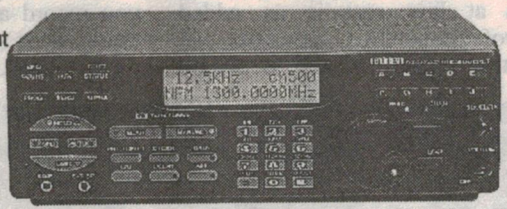
9000XLT Desktop Scanner

The new 9000XLT desktop scanner provides excellent performance and many new functions for ease of operation. It sports a large backlit LCD screen, speedy Twin Turbo operation (scan at 100 channels/sec, search at up to 300 steps/sec) and 500 memories (of which 250 can have alpha character names stored). Frequency coverage is 25MHz to 549.95MHz and 760MHz to 1300MHz, with 4 selectable step rates, 10 priority channels and AM, FM narrow and FM wide reception modes. Supplied complete with an AC adaptor and telescopic antenna.

Other features include:

- Auto memory sorting for faster scanning
- Switchable attenuator to reduce overloading
- Data skip and channel/frequency lockout
- Rotary tuning control
- Scan/Search delay
- Direct keypad frequency or memory entry
- Jacks for line output and Aux. control, and external speaker.

NEW



uniden. Cat D-2739 **$599**

AR8000 Deluxe Scanner

Powerful microprocessor control, a 4-line Alphanumeric display, and a 115 page Instruction manual is proof that the AR8000 is no run-of-the-mill scanner! It provides 500kHz to 1900MHz coverage, with multi-mode reception (AM, N.FM, W.FM, USB, LSB, CW) and a separate 2.4kHz filter for SSB, as well as 1000 memories in 20 banks. There are 19 pre-programmed frequency step sizes, or you can program your own, in multiples of just 50Hz. Other features include 2 VFOs, "New-User" and "Expert" user selectable modes, a Band Scope to check adjacent channel activity, Password protection of memory banks, an inbuilt ferrite antenna for AM broadcast band reception, and much, much more. External computer control is available via an optional interface and PC software. Complete with NiCad batteries, AC charger, antenna, car lead, and carry strap.

Cat D-2728

NEW

AOR **$1299**

DICK SMITH ELECTRONICS

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STORES ACROSS AUSTRALIA AND NEW ZEALAND

B 1978

Construction project:

PC DRIVEN ELECTROCARDIOGRAM

This simple project will let you take your own electrocardiograph, and display it on a PC. With the software supplied, you can read, display, save to disk and print the electrical waveform generated by your own heart (or anyone else's). Powered by a 9V battery and electrically isolated from the computer, the PC-ECG is a safe, low cost way to monitor the electrical activity of the heart.

by GRAHAM CATTLEY

An electrocardiogram (ECG) is a piece of medical equipment used to measure and record the voltages produced as a result of heart muscle activity. By attaching a pair of electrodes (or 'leads' as they are known in the trade) to the hands or chest, our PC-ECG can display the same kind of ECG trace on your personal computer.

Why would you want to build one? Well, looking at the waveforms generated by your heart can be both fun and educational. You can monitor changes to your heart under various conditions, as your heart is affected by many things including emotions, mental and physical activity — even breathing. They will all have a demonstrable effect upon the waveform produced by the heart.

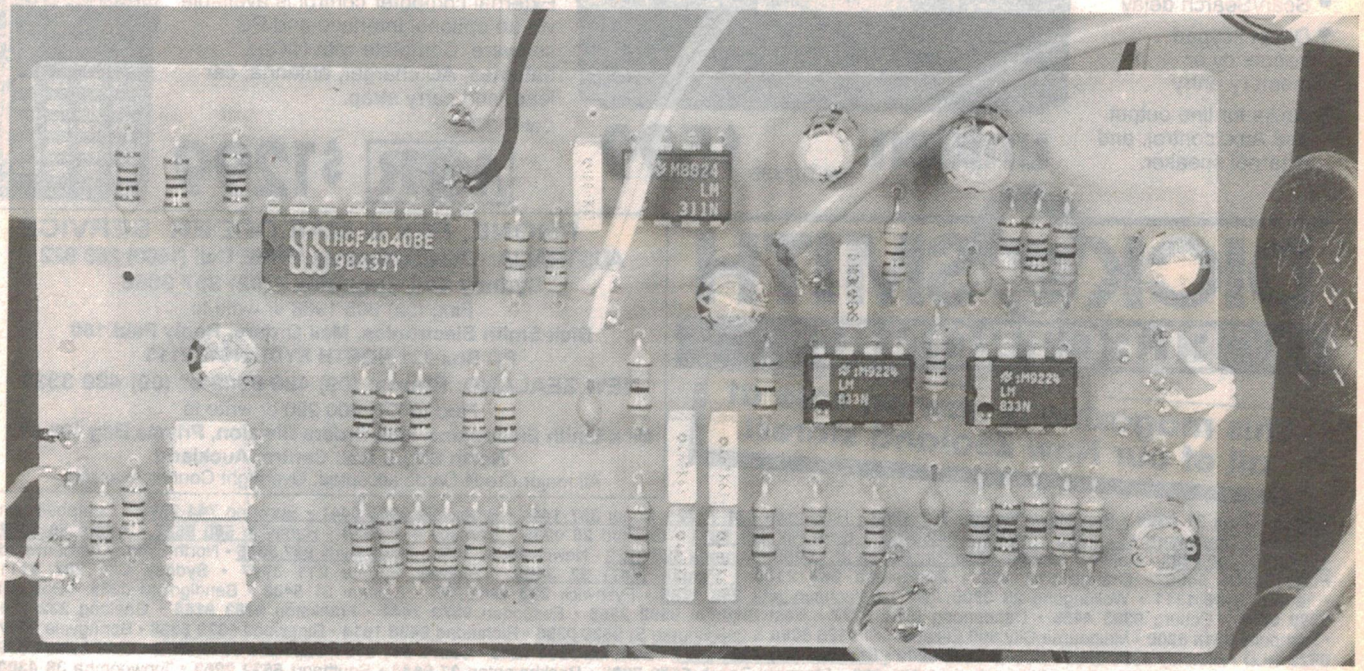
Being able to show this easily, safely and also at low cost is an added bonus. Professional ECG machines can cost anything from $2000 to $8000 and, while this project is not intended to be used as a diagnostic device, the recorded waveform is of a quality approaching that of the professional machines.

A short GWBASIC program has been printed elsewhere in this article, to get you up and running. Unfortunately, due to space considerations, the full version could not be published in this issue. It is, however, available from our reader service mail order division, or, if you have a modem, you can download it from our BBS.

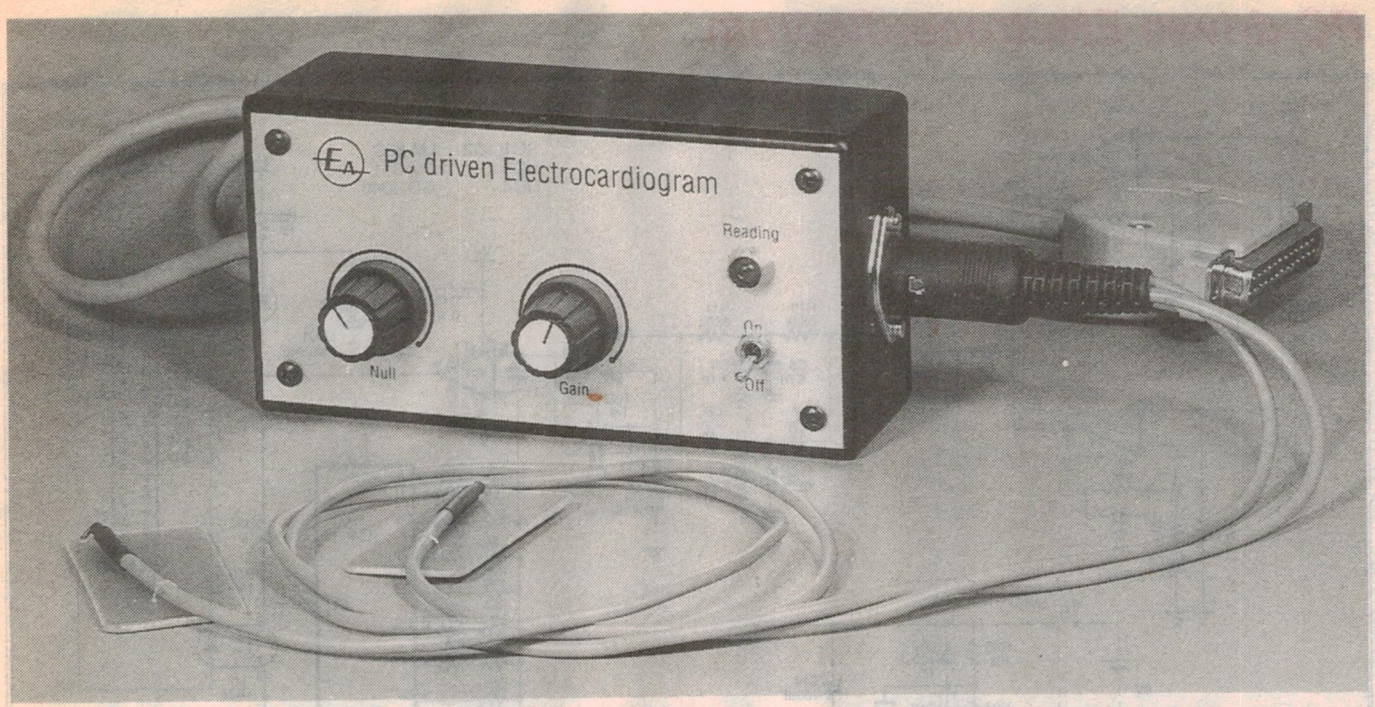
The full version of the software lets you record and view waveforms, print them on a suitable printer, and save them to disk for future reference. You

WARNING!

The main circuit of this electrocardiogram must only ever be battery powered. UNDER NO CIRCUMSTANCES should it be connected to any kind of mains powered supply. This includes all kinds of power supplies, battery eliminators, DC adaptors etc. Connection to such devices could conceivably result in electrocution if a malfunction in the supply were to occur.



A close up of the board. Note that the two 9V power lines were not connected to the DIN socket in the prototype. They were included to facilitate possible future expansion.



can also record at different rates, which effectively lets you zoom in on a waveform for finer detail.

As stated above, the unit is isolated from the computer for safety (after all, it involves strapping two electrodes to either your own body, or someone else's). The circuit has been designed using optocouplers, which ensures complete electrical isolation from any mains power supply. This decision was considered to be of paramount importance, even though it added to the complexity of the circuit. (We do like to keep our readers!)

Basic principles

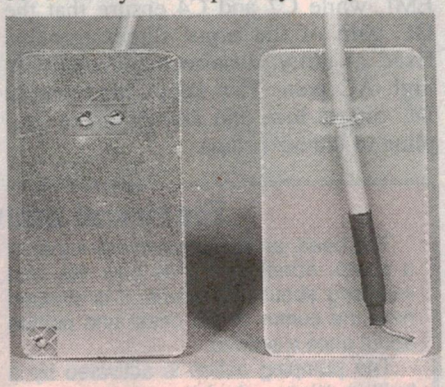
The muscles in the human body are controlled by electrical impulses. These impulses are distributed to the muscles by the nervous system. On reaching their destination, the nerve impulses cause the muscles to contract, and produce much larger electrical potentials which can be detected externally.

Because the heart is a large and rather complex group of muscles which contract cyclically in a preset sequence, it is possible to study the overall condition of the heart by measuring the amplitude, timing and waveshape of the muscle potentials as they are conducted through to the surface of the skin.

How it works

There are two main halves to the circuit: a high gain differential amplifier and an analog to digital converter. Before launching into a description of the circuit, particularly the input stages of the amplifier, a brief outline of the sort of signal we will be measuring may be in order.

The voltage developed across the two input leads will vary according to the position of the leads on the surface of the body, and the resistance between the electrodes and the skin. Of course different people will produce different amplitude signals, and to top it all off, any voltage appearing on the skin will be entirely swamped by stray 50Hz electrical radiation, due to the mains wiring surrounding us.



A front and back view of the electrodes. On the left is the copper side, and on the right, the back of the electrode showing the wire link used to secure the cable.

DISCLAIMER

This project has NOT been designed for medical diagnosis. Correct interpretation of ECG tracings is a complex and skilled procedure, and requires proper medical training. In addition, due to the variable timebase and amplitude, the unit cannot be accurately calibrated, and is presented here as an instructive device only.

Eliminating the 50Hz mains signal is the first priority, and this is achieved by using a differential input amplifier system and heavy attenuation at 50Hz. A differential amplifier (or 'diff amp') works by subtracting one input signal from the other, and producing only the *difference* between the two signals on its output.

As the 50Hz mains hum should be of much the same amplitude and phase on any two close points on the body, all hum should cancel out, leaving only the signal we want to measure. The trouble is that when we get down to practical matters, we find that a few factors that we've conveniently ignored come into play.

Because the body has some resistance between any two points on its surface, the 50Hz AC voltage induced by the changing electro-magnetic field in the environment will be of different phases on different parts of the body. These slightly out of phase signals, when subtracted from one another, tend to produce not zero but a 50Hz signal with an amplitude proportional to the phase difference between them.

Also, the CMRR (common mode rejection ratio) of op-amps is not ideal, and thus the diff amp will pass a small percentage of the hum through. The combination of these two factors means that some of the 50Hz hum will remain. To remove this, a 50Hz 'twin-T' notch filter has been employed, giving the amplifier heavy attenuation (about -80dB) at 50Hz.

PC-driven Electrocardiogram

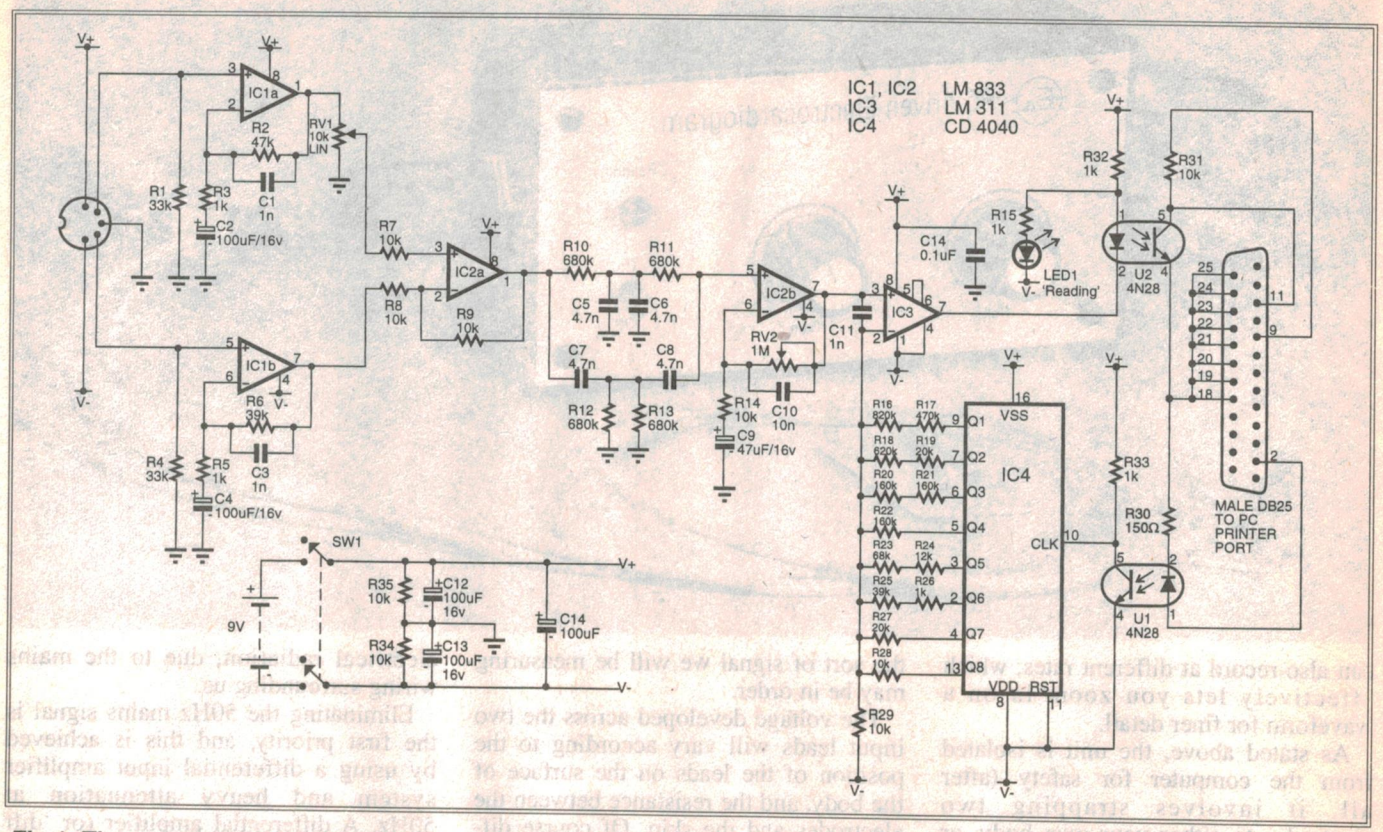


Fig.1: The complete circuit diagram for the PC-ECG. IC1a, IC1b and IC2a form a differential amplifier, IC2b provides most of the gain, and IC3 and IC4 do the analog to digital conversion.

The digital to analog converter section is very simple, based around a software-driven staircase voltage generator and a comparator. It communicates through a two line, opto-isolated interface to the parallel port of the computer, which does all of the hard work. By using only two connection lines and a small machine code routine, the need for eight or more optocouplers (to communicate an eight bit value) was eliminated.

Circuit description

IC1a and IC1b form a pair of high gain input amplifiers, with R1 and R4 reducing the input impedance to 33k — roughly matching the 'output impedance' of the average human being.

Obviously, this impedance will change, according to many factors, including the contact resistance of the electrodes. To compensate for the inevitable difference in amplitude between the two electrodes, IC1a is configured to have slightly more gain than IC1b. Potentiometer RV1 ('Null') is used to adjust the output level from IC1a, to allow equal amplitude signals to be passed to IC2a for hum nulling.

Capacitors C1 and C3 limit the high frequency response of the two input stages, to minimise pickup of noise and EMI, while C2 and C4 ensure that the DC gain of the input stages remains fixed at unity, despite their relatively high AC gain. This keeps their output DC offsets low, and allows direct coupling to the next stage.

IC2a subtracts one signal from the other, and provides a buffered output to the twin-T filter formed by R10-13 and C5-8. With the values chosen for these components, the notch of the filter occurs at 50Hz.

IC2b provides the main gain for the

Electrical activity of the heart

The heart, as you undoubtedly know, is a pump. About as big as your fist, and weighing about 300 grams, it is situated near the centre of the chest and pumps about once a second.

The pumping action is activated by a built-in trigger device, called the SA node. The trigger pulse, once initiated, travels down the heart through preset pathways.

The heart itself is made up of millions of bundles of microscopic muscle cells, which contract when triggered. The muscle cells are electrically polarised like tiny capacitors (positive outside, negative inside) and as the trigger pulse races past them, they depolarise briefly and contract.

Thus, with each beat of the heart, a 'wave of depolarisation' sweeps from the top of the heart to the bottom. It is this wave which can be detected externally and recorded as an ECG.

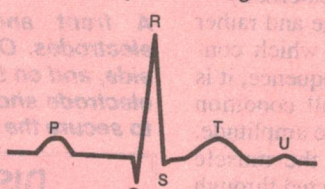
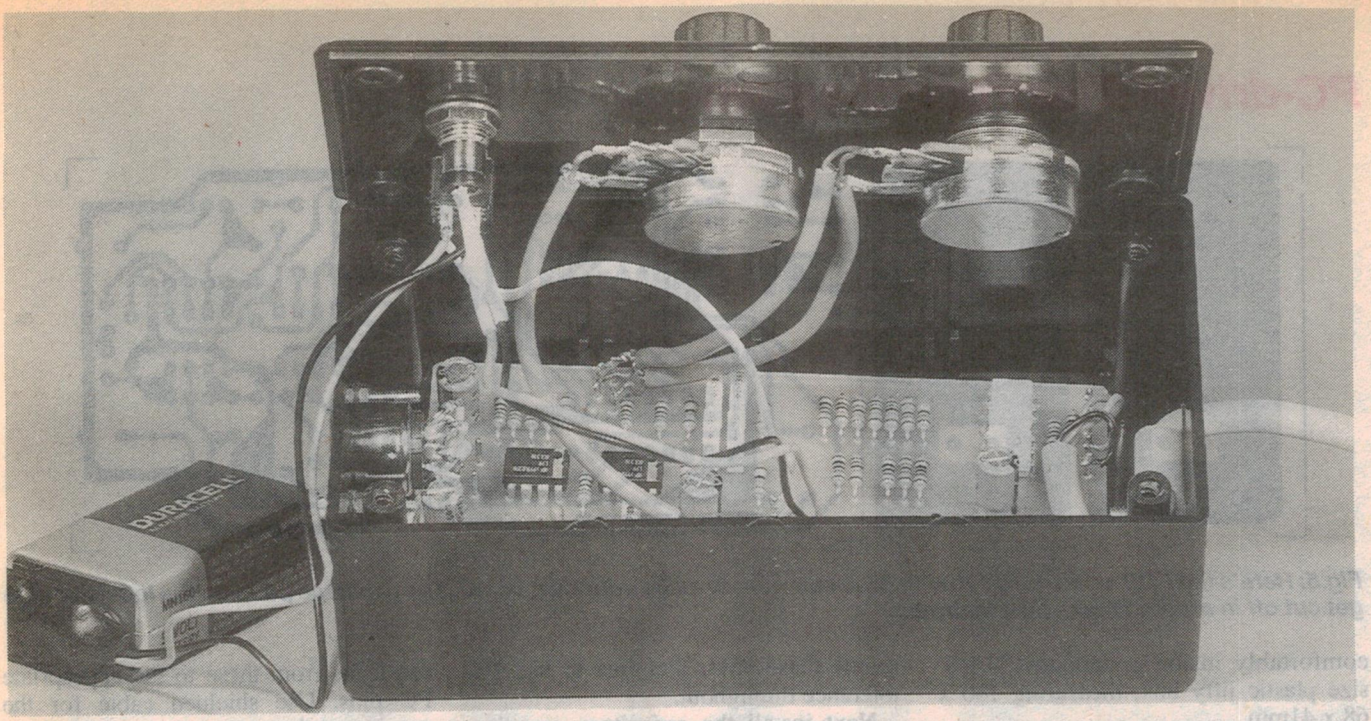


Fig.2

The actual shape of the wave that is recorded depends upon the individual being examined and the positioning of the electrodes, but a general shape is shown in the diagram.

The initial 'P' wave is due to the heart's atria (input chambers) depolarising, while the larger 'QRS complex' section is due to the much stronger ventricles (output chambers) depolarising. Finally, the 'T' wave is due to repolarisation of the ventricles, ready for another cycle.

Doctors are able to evaluate a number of heart problems by measuring the timing of the waves, and their relative heights.



An internal view of the PC-ECG. Use a cable clamp to secure the data cable, and don't forget to use shielded cable to connect the pots.

whole amplifier, with RV2 ('Gain') providing a wide range of gain control.

Leaping now to the other end of the circuit, the D1 line (pin 2) of the computer's parallel port is toggled under software control, pulsing the LED section of optocoupler U1 at high speed. This causes the output phototransistor of U1 to switch rapidly on and off. As the collector of this transistor (pin 5 of U1) is connected to the clock input of IC4, a 12-stage binary counter, this causes the counter to operate and its outputs therefore produce a rising sequence of binary numbers.

Resistors R16 to R28, in conjunction with R29, form a resistor 'ladder' circuit driven by the counter outputs, and as a result the counting action of IC4 produces a quickly rising voltage 'staircase wave' across R29.

In effect, IC4 and the resistor ladder form a very simple digital-to-analog converter, whose output is fed to the inverting input of voltage comparator IC3.

Since the relatively slow moving output from IC2b (our amplified heart muscle waveform) is fed to the non-inverting input of IC3, the comparator therefore compares one signal with the other.

Once the staircase voltage matches the heart waveform voltage, IC3's output goes low, switching on optocoupler U2. The output of U2 is normally held high by the D8 line (pin 9) on the parallel port. This bit is set permanently high by the software, to provide a +5V supply for the collector of U2, through R31.

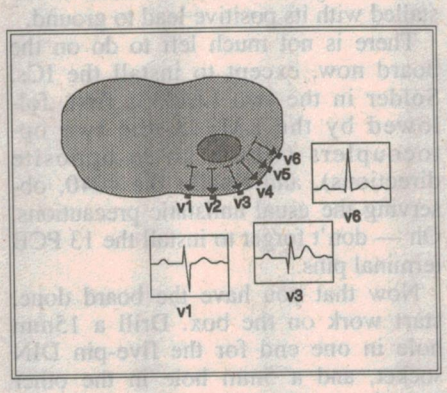


Fig.3: A cross section of the chest, showing the six common lead positions relative to the heart, with their typical waveshapes.

When the phototransistor of U2 conducts, the BUSY line (pin 11) of the parallel port is pulled low, and this is detected by the software. This is in fact how the software senses the value of the heart waveform for that particular sampling, by noting how many clock pulses it has sent out before the comparator registers a 'match'.

Note that LED1 turns on whenever the output of IC3 is high (i.e., when U2's LED is not able to conduct current), and is 'pulse width modulated' during sampling, so that it flickers and gives a handy visual indication of the sampled voltage.

The complete circuit is powered by a 9V battery, with R34 and R35 providing a half-rail voltage signal ground which is well bypassed by C12 and C13. C14 and C15 provide supply rail decoupling for the rest of the circuit.

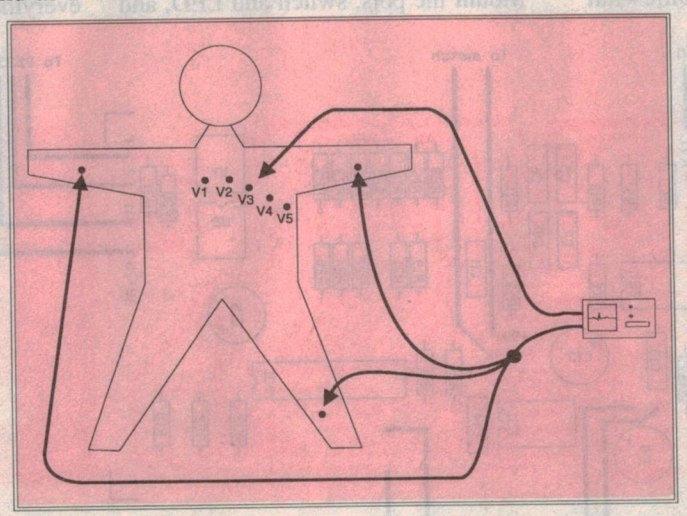


Fig.4: The 'wiring diagram' for taking chest lead recordings. The arms and left leg are shorted together to produce an electrical reference point relative to the six chest lead sites.

Construction

The complete circuit for the PC-driven ECG is wired up on a printed circuit board, measuring 165 x 53mm and coded 95ecg7. The board is designed to fit

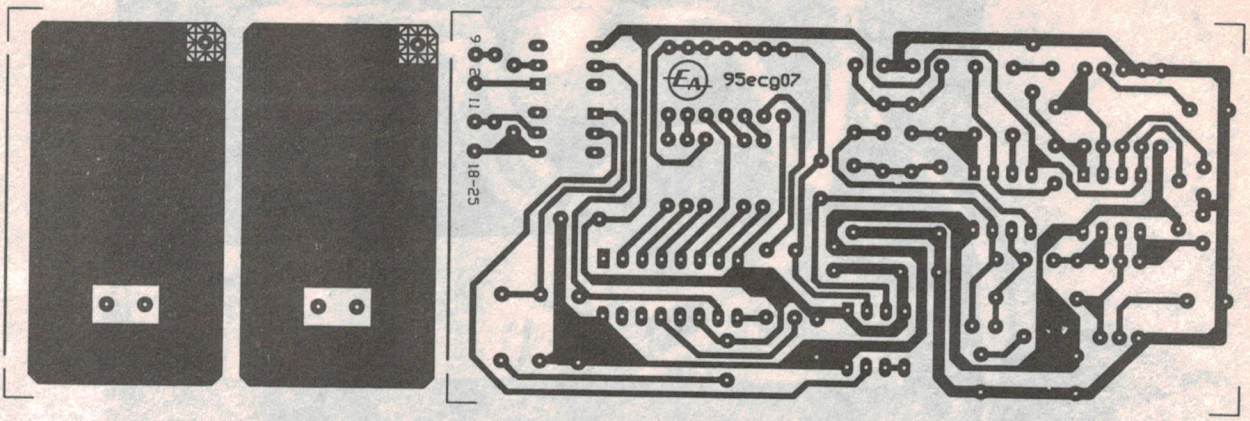


Fig.5: Here's the PCB artwork, full size, in case you want to make your own board. The two large pads on the left hand side get cut off in order to make the electrodes.

comfortably inside a standard 'UB-3' size plastic jiffy box, measuring 130 x 68 x 41mm.

The pattern for the PCB is reproduced here actual size, and as you can see it has two rectangular copper areas at one end. These are destined to become the electrodes, as you may have guessed. They should be sawn off the main board before continuing.

To make a neat job of it, saw the electrodes off the main board one at a time. This is easier than cutting off both electrodes together and then trying to saw between them afterwards.

Although the schematic looks complicated, the PCB is actually quite compact, and construction is very straightforward.

Start construction by installing all 35 resistors(!). Note that 5% resistors have been specified in the parts list for the less critical parts of the circuit, but as 5% resistors are getting somewhat scarce these days, feel free to use 1% tolerance throughout.

Next install the capacitors, ensuring correct polarity for the electrolytics — particularly C13, which should be installed with its positive lead to ground.

There is not much left to do on the board now, except to install the ICs. Solder in the two LM833s first, followed by the LM311, the two optocouplers (which go in opposite directions), and finally the 4040, observing the usual antistatic precautions. Oh — don't forget to install the 13 PCB terminal pins.

Now that you have the board done, start work on the box. Drill a 15mm hole in one end for the five-pin DIN socket, and a 5mm hole in the other for the computer cable. Using a photocopy of the front panel artwork as a guide, mark off and drill the four holes in the lid.

Mount the pots, switch and LED, and run leads from these to the appropriate PC pins. Use shielded cable for the pot connections, to prevent mains hum interference from being picked up by the amplifier.

The five-pin DIN socket should now be connected to the board. You can use a piece of ribbon cable instead of shielded cable if you like, so long as you keep it as short as possible. Now connect the battery clip to the middle contacts of the switch, and wire up the DB25 plug.

This should have pins 18 - 25 shorted and connected to one conductor of the five-way data cable, and also to the shield, if the cable has one.

Connect three of the remaining four lines to pins 2, 9 and 11. Then thread the cable into the box, and connect the four lines to the appropriate PC pins. Install a 9V battery, and put in a small piece of foam packing to keep everything in place. Then screw on the

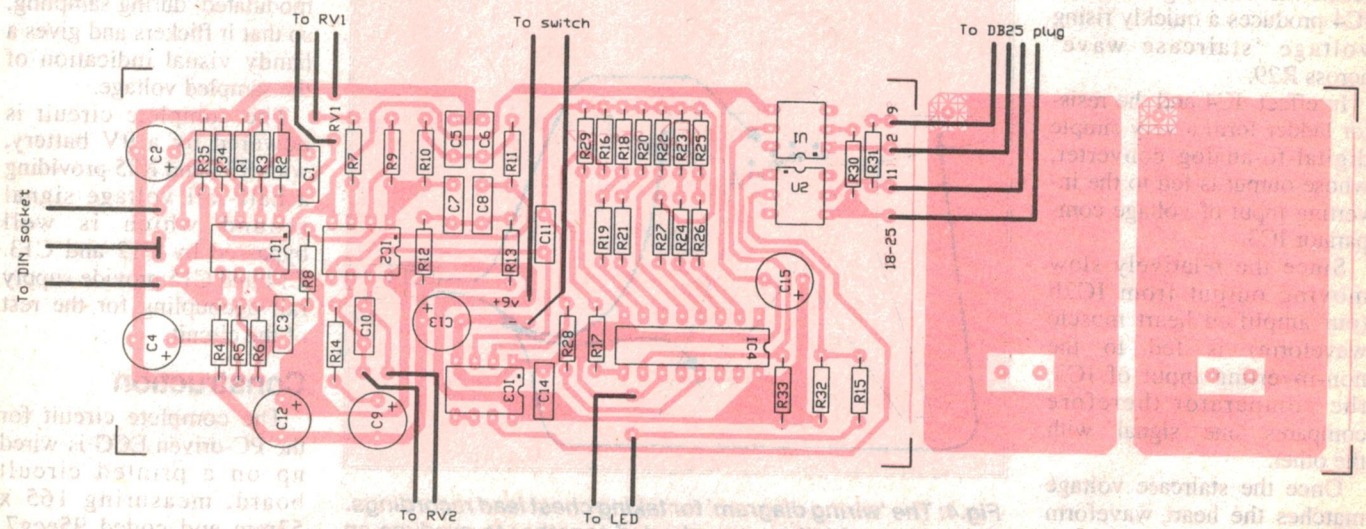


Fig.6: And here's the PCB overlay diagram. Watch the orientation of the two optocouplers and the switch connections.

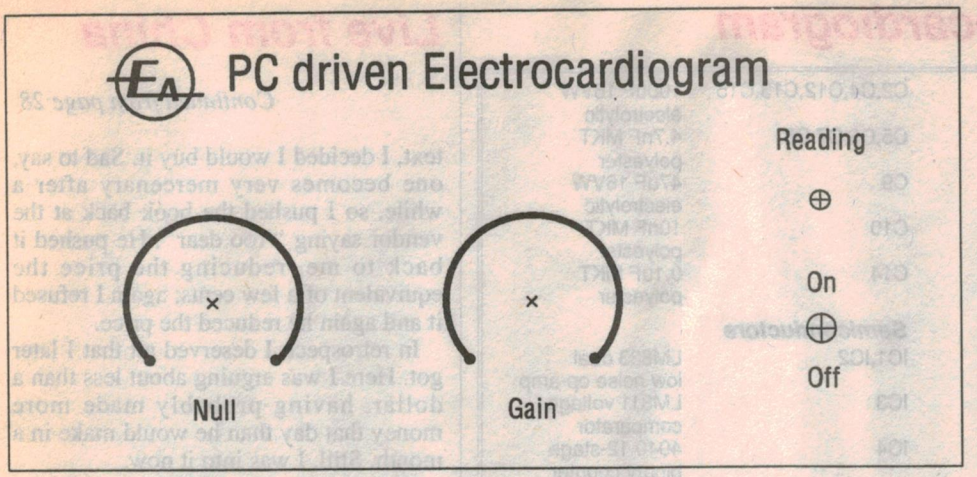


Fig.7: This is the front panel artwork. Use a copy of it when drilling the holes for the pots, switch and LED.

lid, and the DB25 backshell, and get started on the leads.

Lead on...

Carefully sand the edges of the PCB 'electrodes', to make sure that there are no sharp corners. Cut away approximately 10mm of the outer sheath and shield of the shielded cable, and use a small piece of heatshrink to reinforce the cable end up to the exposed centre conductor.

Tin the end of the centre conductor, and solder it to the corner hole of the electrode. A small wire link is used to secure the cable to the other end (see photo). Position the cable to give a small amount of slack to the centre conductor, position the link, and solder it into place. (It might be a good idea to file the solder joints smooth, to prevent any painful surprises later!)

Repeat the process for the other electrode, and wire both of the shielded leads to the appropriate pins of the DIN plug.

Thin white line

Having read the warning box elsewhere in this article, plug the leads into the PC-ECG, plug the DB25 plug into the parallel port of your PC, switch everything on, and run the ECG.BAS program through GWBASIC.

Please note that as the PC-ECG circuitry is completely isolated electrically from the computer, the unit can be connected and disconnected from the computer, even with the power on, without harm coming either to the computer or the PC-ECG.

With any luck the 'Reading' LED should illuminate, and after a few seconds, a trace should be visible on the screen. If the LED does not illuminate, and the computer just sits there, ensure that the PORT variable in line 30 is set to the address of your computer's parallel port. Most computers have a port address of 0378 hex, but a few will have an address of 0278 hex. If your parallel port is not located at 0378, simply change the value in line 30 to the appropriate address.

Hold the leads lightly, one in each hand, and you should, after a few seconds, get something resembling Fig.2 on the screen.

Several factors can influence the quality of the trace, and the most apparent of these is our old foe, mains hum. The 'Null' control is used to cancel most of the hum superimposed on the signal; adjust this knob to get the cleanest trace. The 'Gain' control will adjust the height, or amplitude, of the trace on the screen.

Two other important factors can influence the tracing. The first of these is muscle noise. Electrical activity in the human body is not confined to the heart muscles alone, but is produced by *all* muscles when they contract. Merely wiggling your little finger while recording will completely disrupt the trace. It is therefore important to keep still and relaxed whilst recording.

To this end, the best results are obtained by having the electrodes attached to the subject, rather than having the subject hold on to them. A narrow strip of cloth lightly tied around the arm to secure the electrode in place works well. This prevents the trace from being upset by the muscle noise generated by the effort required to hold the electrodes against the skin.

BASIC software listing:

```
5 ' ECG.BAS PC-ECG driver routine.
10 CLEAR, &HFBFF: DEF SEG
20 DEFINT A-Z
25 ' PORT is the address of the PCs printer port
26 ' DELAY can be changed to give different sample rates
30 PORT = &H378: DELAY = 10:S = &HFC00
40 FOR I = 0 TO 78 : READ D : POKE S+I,D : NEXT
50 DATA &H55,&H89,&HE5,&H8B,&H76,&H08,&H8B,&H14,&H8B,&H76,&H06,&H8B,&H2C,&HBB
60 DATA &H4F,&HFC,&HB9,&H00,&H00,&H42,&HED,&H4A,&H25,&H80,&H00,&H74,&H06,&H41
70 DATA &HE8,&H1D,&H00,&HEB,&HF2,&H89,&H0F,&H42,&HED,&H4A,&H25,&H80,&H00,&H75
80 DATA &H06,&H41,&HE8,&H0D,&H00,&HEB,&HF2,&H43,&H81,&HFB,&HCE,&HFE,&H75,&HD8
90 DATA &H5D,&HCA,&H04,&H00,&HB0,&HFF,&HEE,&HE8,&H07,&H00,&HB0,&HFE,&HEE,&HE8
100 DATA &H01,&H00,&HC3,&H89,&HE8,&H48,&H75,&HFD,&HC3
110 SCREEN 2
120 DEF SEG : CALL S(PORT,DELAY)
130 CLS:PRESET(0,PEEK(&HFC4F)-110)
140 FOR I = 0 TO 640 : Y= PEEK(&HFC4F+I)-110 : IF Y8 THEN LINE -(I,Y)
150 NEXT : GOTO 110
```

PC-driven Electrocardiogram

PARTS LIST

Resistors

All 5% 0.25 watt:

R1,R4	33k
R2	47k
R3,R5,R15,R32,R33	1k
R6	39k
R7,R8,R9,R14,R31	10k
R30	150 ohms

All 1% 0.25 watt:

R10,R11,R12,R13	680k
R16	820k
R17	470k
R18	620k
R19,R27	20k
R20,R21,R22	160k
R23	68k
R24	12k
R25	39k
R26	1k
R28,R29,R34,R35	10k

Potentiometers

RV1	10k linear
RV2	1M linear

Capacitors

C1,C3,C11	1nF disc ceramic
C2,C4,C12,C13,C15	100uF 16VW electrolytic
C5,C6,C7,C8	4.7nF MKT polyester
C9	47uF 16VW electrolytic
C10	10nF MKT polyester
C14	0.1uF MKT polyester

Semiconductors

IC1,IC2	LM833 dual low noise op-amp
IC3	LM311 voltage comparator
IC4	4040 12-stage binary counter
U1,U2	4N28 optocoupler
LED1	5mm red LED

Miscellaneous

PCB, 165 x 53mm, coded 95ecg7; plastic box to suit, size 130 x 68 x 41mm; 2 x 20mm plastic knobs; 9V battery clip; 2m shielded audio cable; 5-pin DIN plug and panel mount socket; 2m 5-way data cable; DB25 male plug and back shell; DPDT toggle switch; 5mm LED bezel; Cable clamp; 13 x PC pins; solder etc.

You may also find that better results are obtained by improving the contact between the electrodes and skin, using a small amount of slightly salty water (or even saliva, in a pinch).

The other important factor to be taken into account is lead polarity. This simply means that if you have the leads around the wrong way, the trace will be upside down. We leave it to the user to work out the solution to this problem...

Chest leads

More traditional looking traces can be obtained by taking readings from various points on the chest. Fig.3 shows the six standard chest lead positions. Note that very small changes of lead position on the chest will result in quite dramatic changes in the waveform.

To see why, you should understand that the voltages produced in the heart's muscles travel in three dimensions through it, and that the ECG trace represents the 'vector sum' of these voltages, in the direction between the two electrodes. In other words, your 'tracing' is a one dimensional view of the wave travelling through the heart, with different lead configurations providing different views of the same electrical event.

With the chest leads being so close to the centre of electrical activity, small positional changes on the chest translate into very large changes of vector. In order to record these vectors, you will need to have some sort of zero reference. What would be nice would be a part of the body that is at zero potential at all times, to use as such a reference. Unfortunately, there aren't any such sites on the body, so we must make our own.

Fig.4 shows how this is done. By shorting together the arms and left leg, the potentials at each of these points cancel each other out, producing a good approximation of zero volts relative to the heart. These points are connected to one input lead of the ECG, while the other is attached to one of the six points on the chest. Fig.4 shows the 'wiring diagram' for such a configuration, as well as the positions of the first five chest leads.

As mentioned previously, moving the chest lead a few centimetres will produce noticeable changes in the waveform. When measuring out on the arms, however, you are essentially reading straight across the shoulders, no matter where the leads are attached.

A final note: Although the PCB electrodes supplied are adequate for short term use, they will oxidize, and require cleaning on a regular basis. Ideally, electrodes made from a suitable non-corroding metal such as stainless steel should be used, and we would recommend that you experiment with various electrode designs.

And remember, should you have any medical queries about your heart or general well being, your local family doctor is always there to help. ❖

Live from China

Continued from page 28

text, I decided I would buy it. Sad to say, one becomes very mercenary after a while, so I pushed the book back at the vendor saying "Too dear". He pushed it back to me, reducing the price the equivalent of a few cents; again I refused it and again he reduced the price.

In retrospect, I deserved all that I later got. Here I was arguing about less than a dollar, having probably made more money that day than he would make in a month. Still, I was into it now.

Eventually we settled on a figure (about four dollars) and he reached into his stock of new books and passed one through the window, then he melted into the crowd and the bus drove off. When I started to look at my new purchase, I discovered that while the sample had been in English, this one was in Chinese. If I had not bargained with him, I wondered, would I have got an English copy?

Still, the photos were good.

Next month, we continue with preparations in Beijing and travel (with great personal peril) to Shanghai, to start building the second site.

(To be continued.) ❖

EXPERIMENTING

Continued from page 41

follow the same principles as the sinewave oscillator circuit — swap the supply rails around and make sure that you reverse the polarity of all electrolytic capacitors. I should state at this point that most circuits don't lend themselves to swapping supply rails around too easily, but those that do are invariably transistor circuits.

This just about leads into the topic of component substitution, certainly a can of worms if one ever existed and a topic that deserves a seperate article. Despite what many purists may say, I believe it can be done in a fair number of cases, provided you're clear on what the circuit has to achieve and that a substitution can be done safely without causing undue stress on any surrounding components. But we'll talk in more detail on this in a future issue.

Well, that's enough for this month. Next month, we'll continue with some more transistor circuits.

(Darren Yates is Chief Engineering Officer with R.A.T. Electronics, of PO Box 641, Penrith NSW 2750.) ❖

Multimedia product review:

MINI BOOSTER AMP FOR SOUND CARDS

This neat little stereo amp from Rod Irving Electronics fits into a PC's standard 3.5" drive bay, and will boost a sound card's audio output to the tune of around 3W RMS per channel. It's powered from the PC's own supply via a spare drive power cable, and offers volume, bass and treble controls, plus outputs for both speakers and headphones.

If your home or office PC is equipped with a typical sound card, you've no doubt noticed — or even been frustrated by — the fairly limited capabilities of the unit's audio output stage. With all but the most up-market cards, this usually amounts to a small stereo power-amp chip capable of delivering a few hundred milliwatts, which drives the speakers via a couple of sockets in the card's rear mounting plate.

In short, this setup tends to deliver a pretty spiritless audio performance. Apart from the usual software-driven output level control, it often doesn't offer the user any convenient means for adjusting the output signal's volume *or* tonal quality — bad luck, if your speakers are a little light-on in the bass or treble area.

The engagingly named 'AMP-001 MPC upgrade kit' featured here appears to solve all of these problems in one hit, and must rate as one of the more ingenious ideas we've come across in the area of add-ons for your PC. With front panel dimensions of just 100mm x 25mm and a depth of around 110mm, the AMP-001 slots neatly into a standard 3.5" drive bay (locating screws included). As you can see from the photo, it then offers a neat little set of user controls (volume, bass and treble) at the front of the PC.

Also included on the front panel is a 3.5mm output socket for headphones and a full-sized 6.5mm microphone input socket, while the rear of the unit has a row of PCB-mounting inline connectors for the main signal in/out and power connections.

Once installed in the PC, the amp is connected to your sound card via a couple of small shielded cables, which are terminated in matching inline connectors. One cable passes the sound card's output signal to the AMP-001's input, while the other simply connects the amp's 6.5mm mic socket directly to the mic input terminals on the card. So in effect, this latter connection just allows the amp to offer a (much) more convenient place to connect a microphone — no more fiddling around at the back of your PC when plugging it in.

The beefed-up audio signal from the amp then passes by yet another connecting cable to a conventional card-type backing plate, which gives you a choice of two RCA style sockets or one stereo 3.5mm socket for the speaker connections. So provided that your PC's expansion bus is not fully populated, the supplied backing plate can simply replace one of the 'blank' plates that's aligned with a vacant expansion slot.

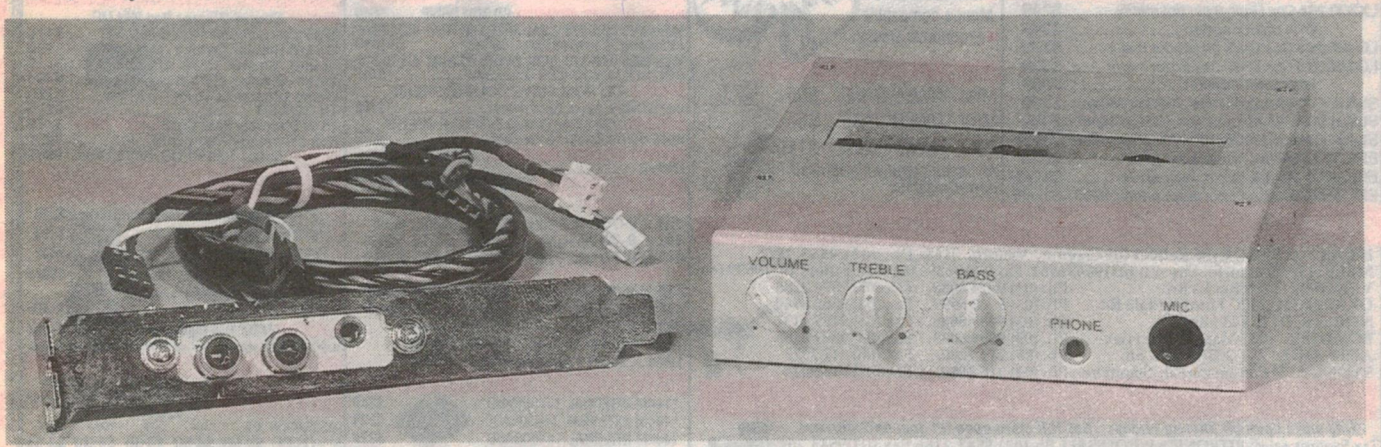
All in all, we found the booster amp quite quick an easy to install, and it was up and running in short order — no I/O addressing or interrupts to worry about with this multimedia upgrade! And while it does add three new loose cables between the front and rear of the PC's interior, the result on the outside of the case is very tidy indeed.

With the AMP-001 connected to our lab PC, we carried out a few performance tests and basic measurements to see how the unit scrubbed up 'on the bench'.

In summary, the unit delivered around 1.8W RMS per channel into 8Ω loads and about 2.9W RMS into 4Ω loads, with a distortion figure of 0.2% THD (1W into 8Ω) and a signal-to-noise (S/N) measurement of 54dB below a 1W output level.

During the course of taking these measurements, we noted that the limiting factor in both the S/N and distortion readings was a low but consistent level

Continued on page 81



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LATEST PENTIUM™ PCI PRODUCTS

RITRON DUAL SYSTEMS

INCORPORATING THE DUAL-SPEED CD CD-ROM DRIVE, 4 MB RAM AND THE CPU PROCESSING POWER OF YOUR CHOICE.

4 YEAR PARTS & LABOUR WARRANTY (FIRST 2 YEAR ON-SITE) MELB MET AREA ONLY

Configuration: • Dual-Speed CD-ROM drive • 4 MEG RAM • 420 MEG Hard Disk Drive • 1 MEG Video Card • 14" SVGA N.I. Monitor- 1024 x 768mm 0.28mm Dot Pitch • 1.44 3.5" F.D.D. • Ritron Mouse Pad • Mouse & Joystick • 101 High Quality Keyboard • 16-bit Sound Card • Magnetically Shielded Speakers • Microsoft DOS 6.22 • Windows 3.11

• **INCLUDE 4 FREE CD SOFTWARE TITLES:** MS Works/Ms Encarta' 95/MS Money & MS Sampler • **20 Mbytes FREE SHAREWARE GAMES.**

CPU CHOICES	TAX EX	TAX INC
WITH MINI TOWER CASING & 200W POWER SUPPLY:		
DX2-66	$1629	$1849
DX2-80	$1699	$1949
DX4-100	$1789	$2049
WITH TOWER CASING & 200W POWER SUPPLY:		
Pentium™ 60	$1999	$2249
Pentium™ 75	$2179	$2449
Pentium™ 90	$2299	$2599

Internal Fax Modem*.$219 extra. (*When ordered with system)

#HOME DELIVERY & SETUP-$50 EXTRA #APPLYS TO MELBOURNE MET AREA ONLY

Choosing the right system configuration have never being so easy. Simply match your needs & budgets to the choices here and you are well on the way exploring the world of multimedia. Each & every systems in its own rights are powerful and will handle today's complex & software applications quite easily.

RITRON QUAD SYSTEMS

INCORPORATING THE QUAD-SPEED CD CD-ROM DRIVE, 8 MB RAM AND THE CPU PROCESSING POWER OF YOUR CHOICE.

4 YEAR PARTS & LABOUR WARRANTY (FIRST 2 YEAR ON-SITE) MELB MET AREA ONLY

Configuration: • Quad-Speed CD-ROM drive • 8 MEG RAM • 540 MEG Hard Disk Drive • 1 MEG Video Card • 14" SVGA N.I. Monitor- 1024 x 768mm 0.28mm Dot Pitch • 1.44 3.5" F.D.D. • Ritron Mouse Pad • Mouse & Joystick • 101 High Quality Keyboard • 16-bit Sound Card • Magnetically Shielded Speakers • Microsoft DOS 6.22 • Windows 3.11

• **INCLUDE 4 FREE CD SOFTWARE TITLES:** MS Works/Ms Encarta' 95/MS Money & MS Sampler • **20 Mbytes FREE SHAREWARE GAMES.**

CPU CHOICES	TAX EX	TAX INC
WITH MINI TOWER CASING & 200W POWER SUPPLY:		
DX2-66	$1999	$2299
DX2-80	$2099	$2399
DX4-100	$2199	$2499
WITH TOWER CASING & 200W POWER SUPPLY:		
Pentium™ 60	$2399	$2699
Pentium™ 75	$2599	$2899
Pentium™ 90	$2699	$2999

Internal Fax Modem*.$219 extra. (*When ordered with system)

#HOME DELIVERY & SETUP-$50 EXTRA #APPLYS TO MELBOURNE MET AREA ONLY

These range of systems offer higher perfomance level with 8 Meg of RAM, a huge 540 Meg hard disk drive and the Quad-Speed CD-ROM drive. Video or animation files will play more smoothly than ever before, off this CD-ROM drive. Internet connection is child's play with these powerful systems.

STUDENT-PRICED SOFTWARE ON SPECIAL!!! DON'T MISS OUT!!

SOFTWARE	Student	NOW	SOFTWARE	Student	NOW
MS Creative Writer ACAD	$78	$73	Simpsons Screen Saver	$52	$47
MS Works/Win ACAD	$108	$103	OS/2 Warp 3-H Red Upgrade	$139	$134
Lotus 123/Win ACAD V5	$175	$165	MS Money/Win	$59	$54
MS Publisher V2/Win ACAD	$105	$100	MS Word/Win V6	$279	$274
Norton Desktop/Win ACAD	$155	$150	Visual Basic/Win ACAD V3	$123	$118

STUDENT MUST PRODUCE I.D. WHEN ORDERING.

Scanmate Colour $349

Economical 24-bit 16.7 million true colour hand held scanner. Includes: • Photofinish 3.0 image editing software • Up to 800 dpi • Twain compliant- scan from within other compatible applications • Smartpage Direct OCR software

SAVE $100 DUE IN FRIDAY

Include interface card, Mediamate Presentation software & User's Manual

Microsoft Bus Mouse

Comfortable, ergonomic mouse. Includes mouse & bus card.

NOW ONLY **$99** SAVE $40

DYNALINK MODEMS

1414VQE High speed desktop fax modem V.32bis (14.4 kps) data & fax modem **$299**

1414VQH High speed IBM card fax modem V.32bis (14.4 kps) data & fax modem **$229**

Bundled with WinFax Lite

GREAT WINDOWS SOFTWARE SUPPLIED

Easy Painter $169

Digitiser pad for natural, freehand drawing movements

HiMouse Cordless $79

Control cursor up to 2 meter

Laser Pointer.....$79

Highlight what you want in your presentations!

VERBATIM DISKS

PLASTIC BOXES	1-9	10+	CARDBOARD BOXES	1-9	10+
3½ DS/DD	$18.95	$17.95	3½ DS/DD	$17.95	$16.95
3½ DS/HD	$23.95	$22.95	3½ DS/HD	$21.95	$20.95
5¼ DS/DD	$13.95	$12.95	5¼ DS/DD	$12.95	$11.95
5¼ DS/HD	$18.95	$17.95	5¼ DS/HD	$17.95	$16.95

YELLOW BOX 3 BUTTON MOUSE

• Serial mouse for IBM or 100& compatible • Multiple Dynamic Resolution: 100-4200 dpi • Microsoft & PC Mouse compatible • Ergonomic Design

ONLY **$11.95**

EPSON PRINTERS

LX300 *264 Cps Draft, 9 pin dot matrix*	$249
With colour option	$349
LQ100 *200 Cps Draft, 24 pin dot matrix*	$289
LQ150 *216 Cps Draft, 24 pin dot matrix*	$339
With colour option	$389
Stylus 400 *48-nozzle inkjet, 180Cps,360dpi*	$389
Stylus 800+ *48-nozzle inkjet, 255Cpi,360dpi*	$469
Stylus Colour *200Cpi,360/720dpi full colour*	$889
EPL 3000 *300dpi, 4ppm, laser printer*	$849
EPL 5200 *300dpi, 6ppm, laser printer*	$1149
EPL 5600 *600dpi, 6ppm, laser printer, RISC*	$1599

NEW!! COMPUTER CASES

MINI TOWER CASE .. $65

MIDI TOWER CASE .. $85

FULL TOWER CASE . $115

All cases come with 200watt power supplies

RITRON COMPUTER SYSTEMS NOW WITH 420 MB H.D.D.

CPU TYPE	GREAT VALUE!!	TAX EX	TAX INC
386DX-40		$995	$1199
486DX2-66		$1145	$1385
486DX2-80		$1225	$1479
486DX4-100		$1485	$1796
Pentium™ 60*		$1525	$1845
Pentium™ 75*		$1699	$2055
Pentium™ 90*		$1799	$2176
Pentium™ 100*		$2390	$2891

*External 256K Cache

4 YEAR PARTS & LABOUR WARRANTY

All systems include: 4 MEG RAM • 420 MEG H.D.D. • *GREAT VALUE!!* • 1.44 MEG 3.5 FDD • Mini or Baby AT casing • 2 SPG Ports • 101 Keyboard • 3 Slots VESA Local Bus Motherboard • 14" SUPER VGA (1024 X 768) (0.28" DOT PITCH) Colour Monitor • VLB 1MB VGA Cards are supplied in 486 machines AT NO EXTRA COST (Up to 1280 x 1024) *Pentium systems now come with PCI Cards and should be bought with 8MB of RAM*

DISCOUNTED SOFTWARE

DOS 6.22	*$89
M.S WORKS	*$99
DOS 6.22 & Win 3.11	*$139
DOS 6.22 & Windows for Workgroups	*$159
MS MONEY	*$39
MS BOOKSHELF	*$99
MS Office Pro	*$775
MS Office Pro Deluxe *(As seen on T.V.)*	*$869
MS Encarta '95	*$99
MS Dangerous Creatures	*$60

*When purchased with a system only.

TERRIFIC VALUE *$62] CD-ROM DRIVE & 16-BIT SOUND CARD

= **$296**

*When purchased with a system

FREE 3 HOUR TRAINING COURSE (MELB. ONLY) FOR ALL COMPUTER SYSTEMS INCLUDING MULTIMEDIA SYSTEMS

UPGRADES & PERIPHERALS FOR YOUR SYSTEMS

SUPA MOTHERBOARD UPGRADES

386SX-40* LM 47	$149
386DX-40* 128K Internal Cache LM58	$229
486DX2-66# 256K Cache L.B	$379
486DX2-80* 256K Cache L.B *NEW!*	$449
486DX4-100* 256K Cache L.B	$549
PENTIUM™ 60MHz/256 C VESA/PCI	$619
PENTIUM™ 66MHz/256 C VESA/PCI	$726
PENTIUM™ 75MHz®/256 C VESA/PCI *NEW!*	$849
PENTIUM™ 90MHz® PCI/VESA	$949
PENTIUM™ 100MHz® PCI/VESA	$1795

*AMD CPU, #CYRIX CPU Without Asterisk- INTEL CPU @ Come with I/O Card fitted on motherboard

CD ROM DRIVES

NEW QUAD SPEED CD ROM DRIVE	$649
WEARNES CDD-110 DUAL SPEED CD ROM IDE DRIVE *(instructions & software (Sony interface)*	$199
WEARNES CDD-120 DUAL SPEED CD ROM IDE DRIVE *with inst & software (CD-I Compatible)*	$199
562J CD ROM DRIVE DOUBLE SPEED *with software drivers for all drives*	$199
563B CD ROM DRIVE DOUBLE SPEED *works with all Sound Blaster Cards*	$289
NEW QUAD SPEED TEAC CD ROM DRIVE	$349

MEMORY

30 PIN SIMM	1-9	25+	100+
1M x 9-70 With Parity	$75	$71	$69
4M x 8-70 No Parity	$249	$238	$234
4M x 9-70 With Parity	$259	$255	$249
72 PIN SIMM FOR PENTIUM™ Processor M.B.			
4M X 8-70 No Parity	$269	$259	$249
4M X 9-70 With Parity	$289	$285	$279
8M X 9-70 No Parity	$529	$469	
16M X 8-70 No Parity	$879	$859	
16M X 9-70 With Parity	$899	$879	

MAESTRO MODEMS LOWER PRICES!

*144M INTERNAL 14400BAUD	$269
*144M EXTERNAL 14400BAUD	$299
144FM INTERNAL 14400BAUD	$329
144FM EXTERNAL 14400BAUD	$349
28.8 FAXMODEM EXT 28,800BPS	$479
28.8 FAXMODEM INT 28,800BPS	$449

FM MEANS FAXMODEM *ONLY A FEW LEFT!!

HARD DRIVES *VOICE COIL IDE HD*

Cap	Av.Access	Tax Inc.	Tax Ex.
260M	16ms	$269	$222
345M	12ms	$299	$249
420M	12ms	$327	$270
540M	12ms	$363	$299
#850M	10ms	$469	$390
#1.08GB	10ms	$599	$499
#1.27GB	10ms	$720	$600
#1 *GB SCSI HD*	10ms	$780	$650
#1.7GB *SCSI HD*	10ms	$1210	$1000
#2.15GB *SCSI HD*	10ms	$1999	$1652

#These drives come with Disk Management Software to overcome DOS limitations. (Drives will normally go to 525MByte max).

SOUNDBLASTER CARDS

NEW Sound Blaster Pro VALUE EDITION with Lemmings & Indy 500	$110
Sound Blaster Deluxe	$65
Sound Blaster 16 bit	$179
Video Blaster SE100	$499
Game Blaster CD16 Pk 7 CD Titles	$799
TV CODER	$279
16 bit Discovery Pack CD16 *2 LEFT ONLY*	$489
8bit Discovery Pack CD8	$299
NEW Quad Speed CD-ROM Drive	$649

NEW MONITOR RANGE!!

All these superb monitors on display at all Stores

• 14" Non-interlaced 1024x768 (0.28mm Dot pitch)	$379
• 15" XGA Analogue 1280x1024	$499
• 15" XGA Digital MPRII 1280x1024	$699
• #17" XGA Digital MPRII 1280x1024	$1049
• #17" XGA Digital MPRII 1600x1280 (0.26mm Dot Pitch)	$1495
• *NEW!!* 20" XGA Digital MPRII	$1999

#15" & 17" Digital Monitor comes with Economy Management Software.

BULK DISK PRICES

PRICES ARE PER BOX OF TEN DISKS — All disks come with Write Protects and envelopes and a life time warranty.

DESCRIPTION	1-9	10+	50+	100+	500+
5¼ DS/DD	$4.50	$4.50	$4.50	$4.30	$3.95
5¼ DS/HD	$7.95	$7.75	$7.50	$6.90	$6.90
3½ DS/DD	$5.95	$5.75	$5.50	$5.25	$5.00
3½ DS/HD	$5.95	$5.75	$5.50	$5.25	$5.00

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YOUR FIRST CHOICE IN QUALITY ELECTRONICS

ESTABLISHED SINCE 1977

NEW KITS NEW KITS NEW KITS NEW KITS

PC- DRIVEN ELECTROCARDIOGRAM

NEW

This simple project will let you take your own electrocardiograph, and display it on a PC. With the software supplied, you can read, display, save to disk and print the electrical waveform generated by your own heart (or anyone else's). Powered by a 9V battery and electrically isolated from the computer, the PC-ECG is a safe, low cost way to monitor the electrical activity of the heart

EA ***JULY '95***

NO PICTURE AVAILABLE AT TIME OF PUBLICATION

K10680 **$38.95**

LOW COST TRANSISTER & MOSFET TESTER

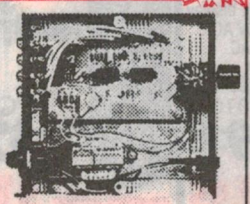
This handy tester is designed to plug into a digital multimeter to provide accurate measurement of transistor beta, to values up to 50,000 or more. You can use it to test small signal, power & Darlingtons transistors &, as a bonus, it will check Mosfets.

SC ***May '95***

K10675 **$29.95**

ECONOMY SURROUND SOUND DECODER

NEW



Perhaps your budget can't quite stretch to the cost of a full "bells and whistles" Dolby Pro-Logic surround sound decoder. Or alternatively, you might be one of those music lovers who doesn't like the idea of subjecting your favourite music to a lot of fancy digital processing. Either way, this really low cost Halfer-type analog decoder should appeal to you.

EA ***May '95*** K10670 **$59.95**

A PHOTOGRAPHIC TIMER FOR DARKROOMS

If you are looking for an accurate way to control film developing times, then take a look at this Photographic Timer. It will switch on mains-powered fluorescent ultraviolet tubes or incandescent lamps rated at up to 1200W for a preset time ranging from 1 - 450 seconds.

Silicon Chip April '95

K10665 **$64.95**

DIGITAL TRIGGER ADAPTOR FOR SCOPES

K10660 **$68.95**

With eight inputs (expandable to 24), this useful device will monitor almost any digital circuit and trigger your oscilloscope only when a preset combination of inputs is found. It also includes an adjustable triggering delay, so it can effectively convert your scope into a low cost logic analyser.

EA ***April '95***

A BUDGET PRICED "SHOESTRING" STEREO AMP

GREAT VALUE! IDEAL FOR SCHOOL PROJECT OR MULTIMEDIA.

K10650 **$99.95**

With a power rating of around 15 watts per channel and impressive noise and distortion performance, this new low cost amplifier is ideal for small hi-fi systems, "home theatre" installations, and a host of other applications. It uses readily available parts, offers a basic range of features, and is very easy to put together. Ideal for school. College or University project or built to work as a computer multimedia amplifier.

EA Dec'94

3-SPOT LOW DISTORTION SINEWAVE OSCILLATOR

This sinewave oscillator is ideal for testing audio equipment & loudspeakers. It provides three switch-selectable spot frequencies at 100Hz, 1kHz & 10kHz, with levels up to 3V RMS & less than 0.004% distortion.

Silicon Chip Dec' 94

K10645 **$49.95**

KITS KITS KITS KITS KITS KITS KITS

CAT	Description	R.R.P
K10005	SOLAR VOLTAGE REGULATOR	$13.95
K10040	ETI 480 50W AMP	$27.95
K10045	ETI 480 100W AMP	$34.95
K10050	ETI 480 POWER SUPPLY	$28.95
K10060	BALANCED MICROPHONE AMPLIFIER	$12.95
K10065	GENERAL PURPOSE AMPLIFIER	$14.95
K10070	BALANCED INPUT DIFFERENTIAL PREAMP	$19.95
K10075	FLOAT NICAD CHARGER	$14.95
K10080	TRANSISTOR TESTER	$22.95
K10085	300W PLAYMASTER AMP	$119.00
K10095	2 TONE ALARM	$9.95
K10100	1.5V TO 9V DC CONVERTER	$13.95
K10105	3 DIGIT COUNTER	$23.95
K10110	ELECTRIC FENCE	$23.95
K10115	ELECTRIC FENCE CONTROLLER	$61.95
K10120	TV PATTERN GENERATOR	$109.00
K10125	UNIVERSAL POWER SUPPLY	$12.95
K10135	LED SCANNER	$17.95
K10140	LOW FUEL INDICATOR FOR CAR	$11.95
K10145	SCREECHER CAR ALARM	$36.95
K10150	12/24V LIGHT CHASER	$21.95
K10160	THERMOSTATIC SWITCH FOR RADIATOR FANS	$31.95
K10180	STEREO FM TRANSMITTER	$33.95
K10155	LOW VOLTAGE CUTOUT FOR CAR /BOAT	$22.95
K10200	IN-CIRCUIT TRANSISTOR TESTER	$14.95
K10205	VHF POWERMATCH	$74.95
K10215	TEMPERATURE PROBE FOR MULTIMETERS	$19.95
K10225	18V / 1AMP BENCH TOP POWER SUPPLY	$79.95
K10260	INVERTER 2KW (NON ASSEMBLED)	$1,495.00
K10265	INVERTER 2KW ASSEMBLED & TESTED	$1,895.00
K10295	LOW OHMS METER	$29.95
K10300	TEMPERATURE ADAPTOR	$24.95
K10305	VOICE OPERATED RELAY	$19.95
K10310	IGNITION KILLER	$22.95
K10315	HEADPHONE AMPLIFIER	$34.95
K10320	VIDEO RF MODULATOR	$17.95
K10325	50W AUDIO AMPLIFIER	$54.95
E10325	PCB 50W AUDIO AMPLIFIER TDA1514A	$19.95
K10335	RGB TO PAL ENCODER MODULE	$49.95
K10340	CAMCORDER MIXER	$29.95
K10345	KARAOKE BOX	$28.95
K10350	REMOTE CONTROL EXTENDER FOR VCRS	$32.95
K10355	HIGH ENERGY IGNITION	$65.00
K10356	BREAKERLESS IGNITION	$44.95
K10360	LOUDSPEAKER PROTECTOR	$29.95
K10370	PORT. 12V LEAD ACID BATTERY CHARGER	$27.95
K10375	15W 12-240V INVERTER	$49.95
K10380	1GHz DIGITAL FREQUENCY COUNTER	$147.95
K10390	LOW COST QUIZ GAME ADJUDICATOR	$34.95
K10400	WOOFER STOPPER	$55.95
K10405	COLOUR VIDEO FADER	$32.95
K10415	PC-CONTROLLED EPROM PROGRAMMER	$99.95
K10425	DELUXE CAR ALARM	$55.95
K10430	REMOTE CONTROL ELECT. COCKROACH	$69.95
K10440	HIGH EFFICIENCY FLUORO INVERTER KIT	$49.95
K10445	IMPROVED DECODER FOR ACS SIGNALS	$19.95
K10450	A SIMPLE LOW VOLTAGE SPEED CONTROLLER	$13.95
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K10475	90 SECOND MESSAGE HOLDER	$97.95
K10476	75 SECOND MESSAGE HOLDER	$93.95
K10480	CONTROL STEPPER MOTORS WITH YOUR PC	$65.95
K10485	EGO TESTER KIT	$19.95
K10490	LOW COST MIDI BREAK-OUT BOX	$32.95
K10495	200W INVERTER KIT	$199.95
K10500	VOICE OPERATED AUDIO SWITCH	$12.95
K10505	SIMPLE LED CHASER	$21.95
K10510	LEVEL CROSSING DETECTOR FOR MODEL RAILWAYS	$34.95
K10515	SOUNDS & LIGHTS FOR LEVEL CROSSING	$37.95
K10520	AN IMPROVED DSO ADAPTOR FOR PC'S	$158.95
K10521	DSO ADAPTOR (INCLUDES ADC0861)	$168.95
K10525	WEEKLY REMINDER TIMER	$19.95
K10530	L/NOISE UNI. STEREO PREAMP	$19.95
K10535	LIGHT & SOUND TRIGGER	$41.95
K10540	50W AUDIO AMPLIFIER	$37.50
K10545	IND. METAL BALANCE DETECTOR	$58.95
K10550	FAST CHARGER FOR NICAD	$42.95
K10555	DUAL ELECTRONIC DICE	$24.95
K10560	DIGITAL VOLTMETER FOR CARS	$40.95
K10565	DIGITAL TACHOMETER FOR CARS	$57.95
K10570	COOLANT LEVEL ALARM	$29.95
K10575	STEAM TRAIN WHISTLE & DIESEL HORN SIMULATOR	$22.45
K10580	BUDGET PRICED TEMPERATURE CONTROL	$39.95
K10585	HIGH-POWER DIMMER FOR INCANDESCENT LAMPS	$69.95
K10595	NICAD ZAPPER	$29.95
K10600	GO/NO-GO CRYSTAL CHECKER	$19.95
K10605	CHAMP PRE-AMP	$9.95
K10610	MINIVOX VOICE OPERATED RELAY	$14.95
K10615	LONG-WAVE AM RECEIVER FOR AIRCRAFT WEATHER INFORMATION	$49.50
K10620	AUTO DISCHARGER FOR NICAD BATTERY PACKS	$27.95
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K10650	A BUDGET PRICED "SHOESTRING" STEREO AMP	$99.95
K10655	DIGITAL EFFECTS UNIT FOR MUSICIANS	$138.95
K10660	DIGITAL TRIGGER ADAPTOR FOR SCOPES	$68.95
K10665	A PHOTOGRAPHIC TIMER FOR DARKROOMS	$64.95
K10670	ECONOMY SURROUND SOUND DECODER	$59.95
K10675*	LOW COST TRANSISTOR TESTER/MOSFET	$29.95
K10680*	PC- DRIVEN ELECTROCARDIOGRAM	$38.95

*SOON AVAILABLE

EAMKIT95-MAY95S

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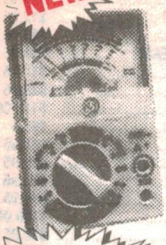
MAIL ORDER LOCAL CALLS: (03) 543 7877

NEW

ANALOGUE MULTIMETER



A pocket sized multimeter that includes 5 functions and 16 measuring ranges. Single knob function control makes it very simple to use. Comes complete with test leads and instructions and is ideal for the handyman - can be kept in the glove box of the car.

SPECIFICATIONS

DC Voltage: 0-2.5-10-50-250-500 volts
AC Voltage: 0-10-50-250-500 volts
DC Current: 0-500µA-10mA-250mA
Resistance: Rx10, Rxl k (centre 3.6)
Battery Test: 1.5V 9V
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DC Current: 200µA-2mA-20mA-200mA-2A-20A
AC Current: 200µA-2mA-20mA-200mA-2A-20A
Resistance: 200Ω-2kΩ-20kΩ-200kΩ-2MΩ-20MΩ
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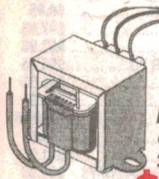

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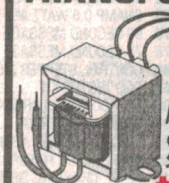

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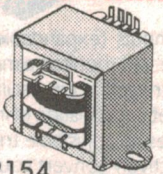

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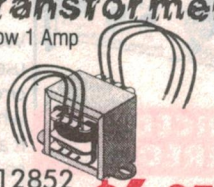

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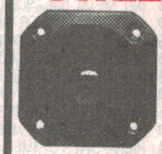

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Using a scope for vehicle faultfinding — 3

In the June edition of *EA*, we covered some more ground in the quest for a better understanding of oscilloscope usage for automotive system faultfinding. This month we conclude the series with a summary of output signals from the ECU.

Let's begin by describing some of the output signals you are likely to encounter out there.

Output signal 'numero uno' is definitely the INJECTOR signal — after all, 'no squirt, no go'. When all is said and done, the ECU boils down to a glorified calculator that takes in voltage measurements and decides how much fuel to inject. ('Gee, that sounds easy, I think I'll build one...')

Offhand, there are at least six varieties of injector signals, which vary pulse width, frequency, or both to achieve the required fuel metering. Figs.1 through 4 show the more common injector signals from the major manufacturers.

Idle speed control

The IDLE SPEED control signal maintains the engine at a constant speed when loads such as lights, wipers, air conditioning and power steering are applied, to keep the emissions within acceptable limits.

Stepper motors or pulse width modulated (PWM) solenoids are used to open a throttle by-pass port, allowing more air into the engine. A quick check here with the scope will reveal whether the device is receiving a signal from the ECU, and if so a diagnosis can be made as to why it isn't making a difference to idle quality. If the engine speed drops noticeably when the air conditioner is switched on, then this function will need to be inspected.

Most faults in this area are to do with the actuator itself, and not the signal from the ECU. Attempts to clean the idle speed control valves/stepper motors have had a patchy success rate, but considering the cost of a new part, it is definitely worth the trouble.

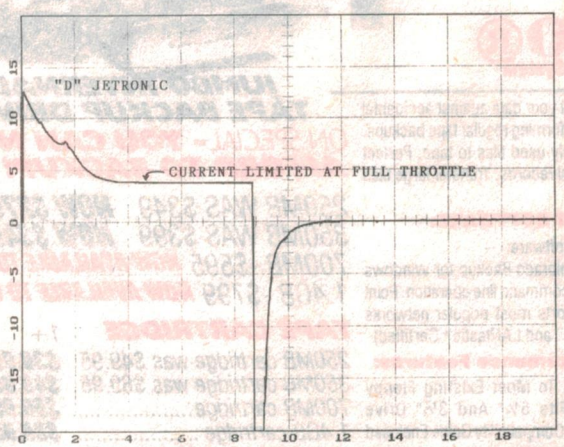
Spark timing

The SPARK TIMING control signal optimises the ignition point for maximum power and economy and also includes momentary ignition retardation at the shift point for automatic transmissions. The thing to look for here is an increase in the 'on time' of the ignition coil, measured at the coil negative terminal.

If you don't possess a timing light, one way of using your dual-trace scope to see if the ignition timing is advancing. Attach one probe to the switched side of an injector and the other probe to coil negative, raise the idle speed and observe the change in timing relationship between the two. You may need to use the external trigger port of your scope and attach an inductive probe to a spark plug lead, or use a few turns of wire around the plug lead as I described in the April edition of this series under 'Triggering', to achieve a stable display.

A/C clutch engage

The A/C CLUTCH engagement signal is sent to the compressor only after the ECU raises the idle speed control setting to allow for the extra engine load. Things to look out for here are spikes at the switch-off point. Probe as close as possible to the positive connection on the air conditioning compressor; the voltage should drop from system voltage to ground without any spikes at all, as shown in Fig.5(a). A protection diode is wired across the terminals on all modern vehicles, to prevent damage to sensitive electronics.



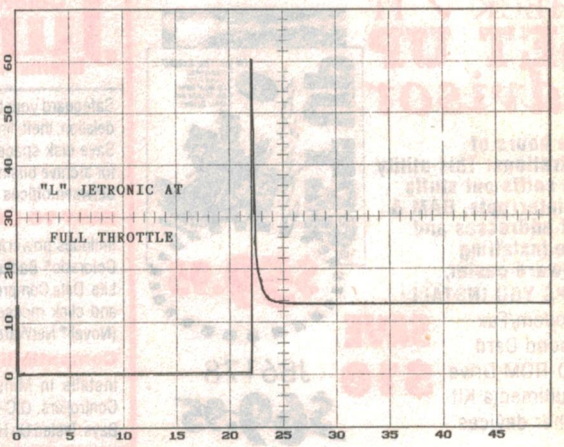


Fig.1 (left): First there was 'D' Jetronic, producing the injector waveform shown here. Fig.2 (right): Next came 'L' Jetronic, with this rather different waveform.

A case in point is a vehicle that kept blowing the climate control unit with monotonous regularity. The service company was going spare, trying to find what was going on. The voltage regulator was suspected as a possible cause, but any tests always proved OK. They got quite good at removing the controller after a while, but the customer was getting fed up with paying, understandably!

Eventually the scope found the problem — a blown protection diode, producing the negative spike shown in Fig.5(b). As before a digital multimeter simply doesn't have the bandwidth to see, let alone display, such a brief event.

You can see from this example that scope usage can be a life saver, can't you? The winding in the compressor clutch has hundreds of turns and works like an ignition coil whenever the power is turned off! (Fortunately there is no secondary winding, or things would look pretty grim for the poor old protection diode...) Without the protection diode, the A/C clutch winding becomes pretty deadly in its effect on the electronics.

Anyone familiar with late model Jaguar vehicles will know that the wiring loom is festooned with protection diodes, to make absolutely certain that the integrity of the electronics is maintained.

Fan control

Radiator and air conditioning COOLING FANS are controlled by the ECU, via the engine temperature sensor — why have two sensors when only one will do? Check for clean switching and voltage drop in the fan control signal, as close as possible to the fan motors.

Cruise control

CRUISE COMPUTER signals are decoded by the dashboard display to reflect fuel economy and engine speed. Generally a PWM signal (for the economy calculation) similar to the injector signal but without the 60 volt spike, and a variable frequency signal (for engine speed) of either 5V or 12V amplitude, are all that is required. Another processor is often used in the instrument display unit to calculate the rest of the data.

Door locking

A DOOR LOCK signal (12V DC on or off) is sent by the ECU to the central locking system, to activate the door locks when in 'Drive' mode. I sincerely hope that Australia doesn't ever need to implement this kind of security device!

A few other peripheral engine management signals are used such as the EGR (exhaust gas recirculation, to reduce oxides of nitrogen) valve activation, carbon CANISTER PURGE valve switch, EGO (exhaust gas oxygen) sensor heating, and various buzzers and warning lights, etc.

When it comes down to diagnosing driveability and/or fuel consumption problems, it should be beginning to look easier to understand, based on a working knowledge of how the system operates.

The first thing to do is identify the type of EFI or engine management system you are dealing with. If it's a basic 'L' Jetronic type, then all it does is simply inject fuel by varying the pulse width to the injector. If you're dealing with a more complex Motronic or ECCS system, then ignition timing control with variable 'dwell angle' and idle speed controls are thrown in.

It is important to know what kind of signals to expect, and one way to find out is to map out every good vehicle that comes into your shop. A digital scope of course would allow you to print off all the waveforms of every signal and produce your own set of reference manuals for each and every vehicle on the road. Building up a library of perfect waveforms would be nice, but quite laborious. Or you could settle for a generalised overview with some kind of backup system, which I'll discuss next.

A 'movie' library

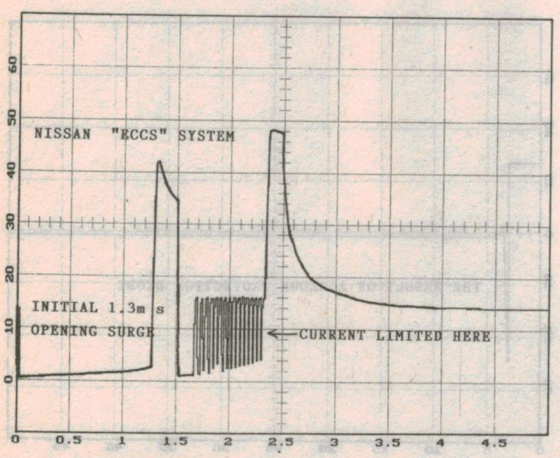
In this series I have included as many pictures as possible (whilst still leaving room for some words), to illustrate the advantages of the oscilloscope over the digital multimeter. This still leaves a large knowledge/experience gap in the newcomer to the oscilloscope.

In an attempt to fill that gap, my good friends at Sydney based Autodiagnostic Systems have made available an offshoot program from their PC-based Tunescope software, called 'SCOPEMASTER'. The library of 'stills' and 'live' waveforms has steadily grown since the release, three years ago, of their ADS9000 Tunescope and you, dear reader, can draw from other people's experience.

Supplied on two high density 3.5" diskettes, plus a manual written by yours truly, the program includes files of captured waveforms from a wide range of vehicles. A selection of signals from vehicles in various degrees of disrepair is supplied, along with details of the voltage and timebase settings used to view them.

Obviously there is a great advantage in being able to view the signals under live conditions, but this is not always possible. The next best thing is to replay the signals, or similar ones, apply measuring cursors to the waveshapes to resolve things like voltage, time, frequency or degrees of distributor rotation — whatever is applicable — and the program does just that.

Having the ability to read the waveshapes without the distractions of engine



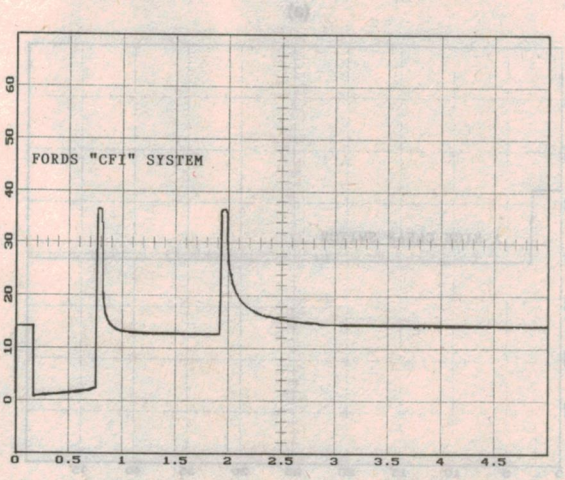


Fig.3 (left): Then Nissan confused us with the ECCS system, with this kind of injector signal. Fig.4 (right): Not to be outdone, Ford came up with the CFI system with yet another kind of injector control signal.

noise and exhaust gas is a definite bonus. See my advertisement under SCOPEMASTER, in this month's 'Marketplace'.

Unleaded fuel — why?

The change to unleaded fuel was introduced largely by the political manoeuvring of the major car manufacturers of the world, in response to concerns about air pollution. I suppose when you employ either directly or indirectly about half of the western world, you've probably got some political clout...

This change allowed the use of a relatively inexpensive device called the oxygen or lambda sensor, to effect a 'closed loop' control cycle for the injection process. Based on the incoming information, the ECU decides to squirt in 'X' quantity of petrol; the O_2 sensor sends back a signal 'too rich' or 'too lean', and the ECU adjusts the mixture constantly to try and keep to the theoretically perfect mix.

It is possible to produce an O_2 sensor that will withstand the Tetra-Ethyl Lead in 'super' fuel, and Messrs. Bosch and NGK do just that; but the cost is significantly higher. A return to 'super' fuel technology would have the green lobby blowing pressure relief valves everywhere, so for now we have acid rain instead of lead and hopefully a reduction in carbon monoxide and hydrocarbons.

Where are we headed?

So why did the manufacturers go to all this trouble? We certainly have a much tighter control over fuel metering and ignition timing these days, but have we got better fuel economy as a result? Not much.

I have seen a similar dichotomy developing with battery packs for notebook computers. The minute new technology offers a more powerful type of battery, the more features notebook manufacturers cram into their products — effectively negating the increase in power.

So whilst engine efficiency has improved dramatically since the introduction of unleaded fuel and closed-loop fuel correction, there has been little improvement in economy overall. Specific fuel consumption by the engine alone has actually improved quite a lot, but we do like our creature comforts, don't we?

Almost all new vehicles sold these days have power steering and air conditioning. Most have automatic transmissions, and quite a lot have 'fast glass'; these parasitic consumers add up.

If you are after economy first and foremost, stick to vehicles with manual transmission and manual windows. Turn on the air conditioning only on really hot days and to defog the windscreen in winter, and always keep the tyres pumped up to 220kPa (32psi) minimum.

Electric non event

Electric cars are still, in my opinion, a non-event. Consumers have been cosseted with such creature comforts as heating, air conditioning, demisters, electrically operated windows, mirrors and seat adjustments, remote central locking, alarms, door lock heaters, seat heaters and in-car entertainment systems — all of which combined, consume vast quantities of electrical current. The electric car needs all the power it can get, just to propel itself up to speed at a reasonable rate, without running any extra loads to keep the occupants comfortable and amused.

Has anyone considered what to do about disposing of all the battery packs that will only last two years at best? Can we adequately reprocess severely sulphated lead-acid and dead nickel-cadmium batteries, or will we have a de-facto pollution problem on our hands further down the ecological track?

These questions and more assail the worried minds of many a good man, and your faithful scribe can do no more than wonder what the future holds — or indeed, who holds the future...

Now that unleaded fuel usage is hovering around the 50% mark in Australia, and more and more lead is being removed from 'super' fuel, I wonder how long it will be before the 'green' agenda will turn up the acid rain debate to full heat over here?

It certainly looks like CNG (compressed natural gas) as a fuel for the motor car is looking better and better, with its 16:1 air/fuel ratio versus the 14.8:1 for ULP (unleaded petrol), no acid rain problem, and 25% less greenhouse gas (CO_2) emissions — combined with great driveability, little if any loss of power and absolutely no lead. How perfect does it need to be, to make everyone happy?

On the pollution front, power generation to feed these so-called zero emission electric vehicles will need to be upgraded. Maybe the oil companies could build the extra power generators to supply the national grid?

I can just imagine the greenies having apoplexy now... 'Major oil company plans to build new power station adjacent to Lucas Heights' — oil fired of course! I wonder how big the catalytic converter would have to be on their smoke stack?

Is that a silver lining I can see up on those clouds, or is it some other heavy metal? Cheers for now! ❖

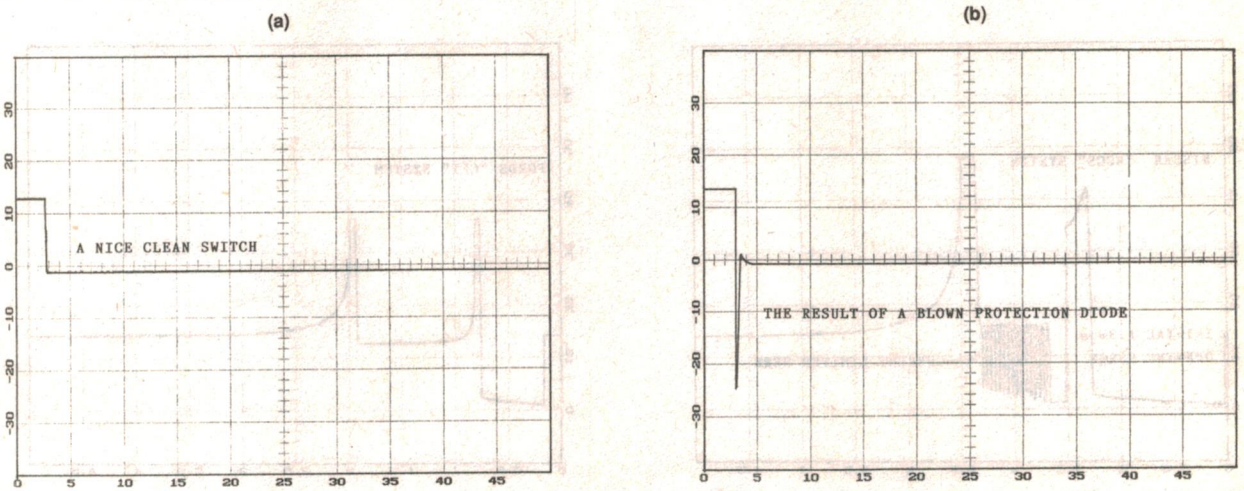


Fig.5: The waveform in (a) is that across an air conditioning clutch winding that its operating correctly, while that in (b) shows what happens when the protection diode is blown. Note the sharp negative spike.

Mini Construction Project:

'POSTAGE STAMP' MICRO FLASHER

Here's a little project that's ideal for anyone wanting to get some 'hands on' experience with surface mount components and construction. It's a very simple and low cost twin-LED flasher, which once you've built it can be used as a piece of novelty jewelery, for 'flashing lights' in a model train layout, or any similar application.

by JIM ROWE

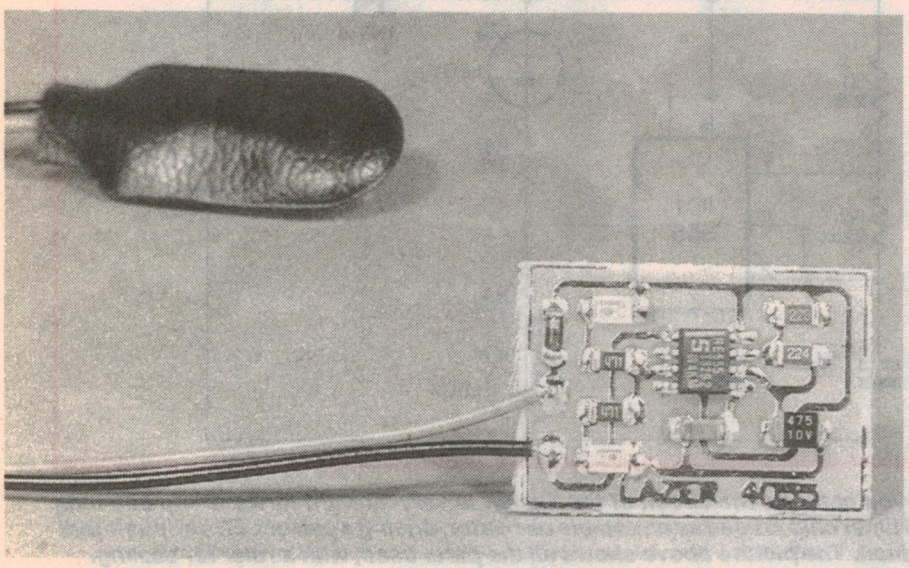
Surface mount technology is steadily shrinking electronic components, and changing the way they're handled and the way they're used to build up circuits. Undoubtedly SMT is the future of electronics, and that means that we all need to get experience with it. Even though SMT parts are basically designed for automated assembly, there's still going to be a need for manual servicing. As SMT parts gradually replace conventional leaded components, we're also going to have to use them for building our 'one off' projects manually...

But how do you get experience with SMT, on a small scale and as an individual? Most SMT components are sold on large reels, intended to be loaded into the 'pick and place' machines which place them onto the PC boards before the automated soldering operation. Very few suppliers make surface mount parts available in small quantities, for the hobbyist or individual technician.

That's where this little project comes in. It's been deliberately designed to give experience in manual handling and assembly of SMT components, and Lazer Installations, whose principal Anthony Moutopoulos developed the project, is also able to supply complete kits for it direct — at a very low price. This should make it very attractive as a 'learn while you build' project, for TAFE colleges as well as individuals.

Apart from the battery (a standard 9V, 216-type), all of the components fit on a tiny PC board measuring only 26 x 18mm. Literally, it's the size of a postage stamp!

The quoted price for each kit is only $6.00, including packing and postage within Australia. This should be well within just about everyone's budget. Full details of the kit's availability are given in the parts list.



The circuit

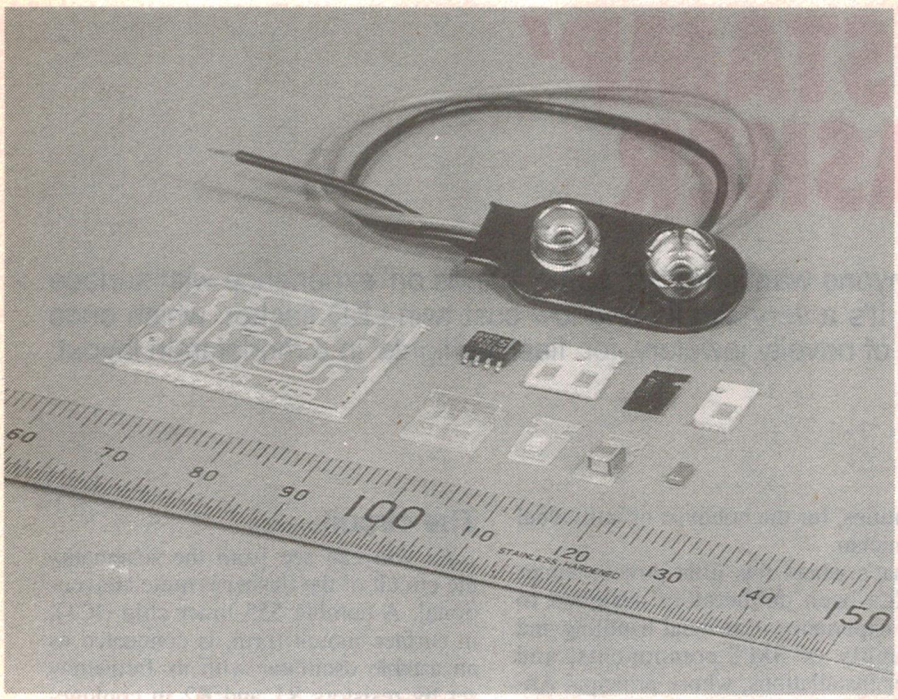
As you can see from the schematic, the circuit of the flasher is quite conventional. A humble 555 timer chip (IC1), in surface mount form, is connected as an astable oscillator with its frequency set by resistors R1 and R2 in conjunction with capacitor C2. The output of IC1, at pin 3, therefore produces a square wave of about 1Hz, with an amplitude very close to the supply voltage — which is 9V minus the voltage drop in protective diode D1.

By connecting the two LEDs as shown, with their series resistors R3 and R4, the 1Hz square wave from IC1 is made to flash the LEDs alternately. LED1 glows when the voltage at pin 3 is low, while LED2 glows when it is high. So only one flashes at a time, and they both flash at a 1Hz rate.

Capacitor C1 is the usual bypass for the trigger or 'threshold control voltage' input of the 555, to ensure that it oscillates smoothly and reliably. And diode D1 is basically to prevent current flowing, if the battery is connected to the circuit with the wrong polarity — otherwise the consequences could be expensive!

In terms of circuit operation, then, the flasher is very straightforward. The only difference is that in this case, all of the components we're using are in very small surface mount packages. The IC package measures only about 4.5mm long by x 5mm wide (including 'gull-wing' leads), by about 1.5mm high — and that's the largest component by far. The LEDs measure only about 2.8 x 1.9mm by 1mm high, while the resistors and capacitor C1 are in the '1206' SMD package, measuring a mere 3.0 x 1.5mm in area and less than 1mm high.

'Postage Stamp' Micro Flasher



You will almost certainly need a magnifying glass or similar, to help you in building this project! Other handy tools to assemble are a good pair of tweezers and a few toothpicks — along with a soldering iron fitted with a very fine pointed chisel bit (clean and well tinned), and of course some very fine-gauge resin core solder.

Construction

Firstly inspect the PCB board for any shorts, or open circuits. Next make sure that you place all the components on a very clean clear area, so you can use the tweezers to pick and place them on the board as required.

As an assembly hint, it is suggested that you use either 'BLU-TAK' or double sided sticky tape to anchor the (very) small PCB on the assembly surface, while you're adding the components.

Be very careful to identify the various components, because they're so small. The two LEDs are quite easy to identify, with their white rectangular shape and pink tops — but note that at one end, there's a small strip of metallisation along the top to indicate the cathode end. The PCB overlay diagram shows which way around LED1 and LED2 are fitted to the board.

The IC is also quite easy to identify, with its eight 'legs'. The surface-mount package doesn't have a dot or dimple at the pin 1 end, or even a notch; however there is a paint band along the top at that end, and the overlay diagram again shows which want around the chip is fitted to the board. Of the remaining components, electrolytic capacitor C2 is quite easy to pick — it's the largest, and has an almost square black body with a marking of '475 10V' on the top, along with a bar to indicate the positive end. Capacitor C1 (0.1uF) is in the much smaller 1206 package, the same size (3 x 1.5mm) as the resistors, but with either a '104' marking or a brown body without any markings at all.

The resistors are all in a 1206 package, with a black or dark green body but with markings which make it easy to identify them (see parts list).

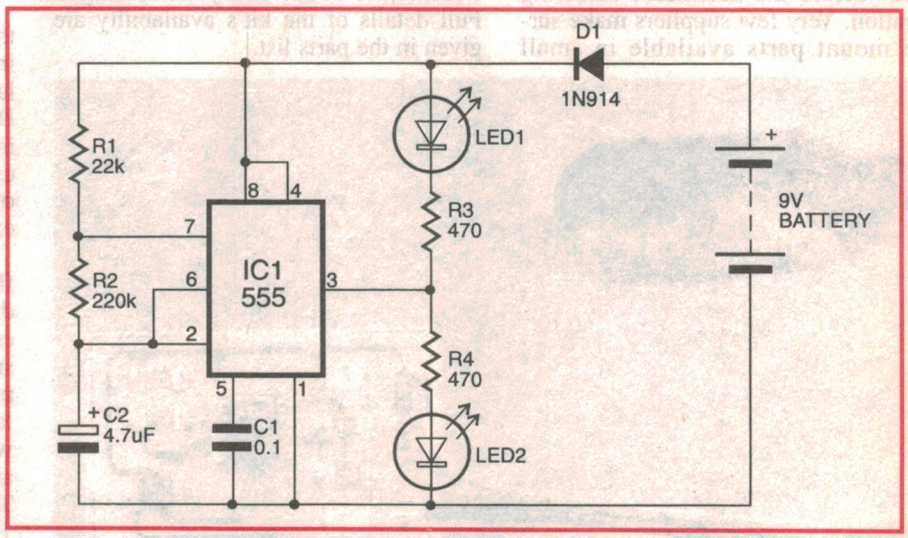
The remaining component to identify is D1, the protection diode. This is in a small cylindrical glass package about 3mm long by 1.2mm in diameter, with a copper-coloured band visible around the cathode end. As before the overlay diagram shows the way this part is orientated on the board.

The actual assembly

With the parts all identified, the next step is to fit them to the board. This is a bit fiddly, because SMT parts are really not intended for manual assembly. But if you work carefully and follow the procedure to be described, it shouldn't present any problems.

Before attempting to solder each part to the board, pre-tin each of the corresponding board pads, using your fine-pointed iron and very fine gauge solder (definitely not the kind you use for soldering gutters!). This should leave a thin 'cushion' of solder on each pad. Then move the component into position, with its ends or leads sitting on the pads, and hold it in place — using the end of a toothpick, or a fine pair of tweezers if you prefer. Finally, re-apply the tip of the soldering iron so that it contacts both one end of the component and its solder 'cushion', whereupon the solder should reflow and fuse the two together.

Initially, you only need to solder one end (the 'easy' end) of each of the smaller components in this way, to attach them to the board. The main thing



As you can see, the circuit of the flasher is very straight forward — a common 555 timer chip is used as an astable oscillator, driving a pair of LEDs in 'push-pull' fashion. The picture above shows all the parts used, with a ruler for scaling.

PARTS LIST

(All parts in SMD form.)

Resistors

R1	22k ('223')
R2	220k ('224')
R3,4	470 ohms ('471')

Capacitors

C1	0.1uF ('104', or brown body with no marking)
C2	4.7uF 10VW ('475 10V')

Semiconductors

D1	1N914 (cylindrical glass body)
LED1,2	Red LED
IC1	555 timer

Miscellaneous

PCB, 25 x 18mm, RCS code 4055s; 9V battery snap connector with leads; 9V 216-type battery.

is to ensure that the component doesn't move out of its correct position, or stand on end like a 'tombstone', while the solder is in the liquid form.

Of course you should also prevent it from moving until the solder solidifies, to ensure a good joint. Don't exert too much pressure on the component, though — if it ends up stressed, it may very well fail.

This procedure should be followed with all of the smaller parts, and is only modified slightly for the IC. With the latter you can solder say pin 1 first, then check that all of the remaining pins are positioned squarely over their respective pads. Then you can solder pins 2-4 on the same side, if all seems OK. This will anchor the chip to the board quite firmly, allowing you to come back and solder the remaining pins after you've soldered the 'other ends' of the smaller parts.

This 'one end of all parts first' approach has the advantage that you don't have to keep turning the PCB around all the time. It also ensures that each part can cool down from the first soldering, before it gets heated up again...

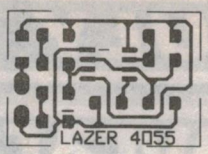
Perhaps we should stress again here that you should take great care to fit the polarised parts (the LEDs, diode D1, capacitor C2 and the IC) to the board with the correct orientation, BEFORE soldering even one end to the board. These parts can be *very* hard to remove again without damaging them, if you discover later that you've installed them the wrong way around.

Resoldering or 'reworking' is NOT recommended — so your motto should be 'LOOK BEFORE YOU SOLDER'.

Take special care when you're soldering the IC pins, because the chip can easily be damaged if you leave the iron on too long and it's overheated. After soldering its pins (which are spaced at 0.05" — half the spacing of conventional DIP pins), examine them very closely with a magnifying glass to ensure that you haven't left any solder bridges.

Finally, solder the red and black wires from the 9V battery snap connector to the PCB, with the red wire going to the '+' pad near D1, and black wire to the '-' pad.

Note that complete kits (apart from the 9V battery) for this project are available from Lazer Installations, PO Box 13, Little Bay 2036. The cost is $6.00 per kit, including packing and postage anywhere in Australia. Payment can be by cheque, cash or money order; however credit card orders can't be accepted.



For those who wish to etch their own board, here is the pattern, reproduced actual size as usual.

Trying it out

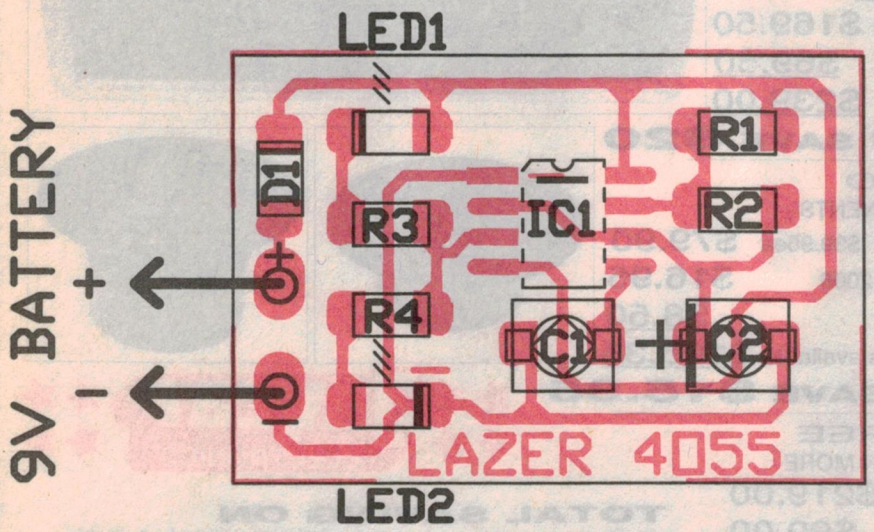
Your flasher should now be complete, and connecting the battery should reward you by having the two LEDs begin blinking, in alternate 'push pull' fashion.

That's all there is to it. Building your flasher will give you good 'hands on' experience with manual assembly of SMT components, while the finished flasher can be used for all kinds of things. Have fun!

By the way, kit supplier Lazer Installations is also able to supply a range of surface mount components, in small quantities and for very reasonable prices. For example they have 5% '1206' sized resistors in a range of handy values between 47 ohms and 1M, for a price of $1 for a quantity of 12. Similarly there are capacitors in many handy values between 2.2pF and 0.1uF, again in 1206 size and priced at $1.50 for a quantity of 10.

SMD LEDs are available in red, green and yellow at three for $1.00, while SMD 555 timer chips are three for $2.00.

The minimum order for these SMD components is $5.00, plus $1.00 for packing and postage anywhere in Australia. The address information is shown in the parts list. ❖



Here's the overlay diagram for the flasher, showing where everything goes and also how the various parts are orientated. The text explains the recommended way to solder the very tiny surface mount components to the board.

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Jaycar Vifa

AS REVIEWED IN ELECTRONICS AUSTRALIA JULY 1995

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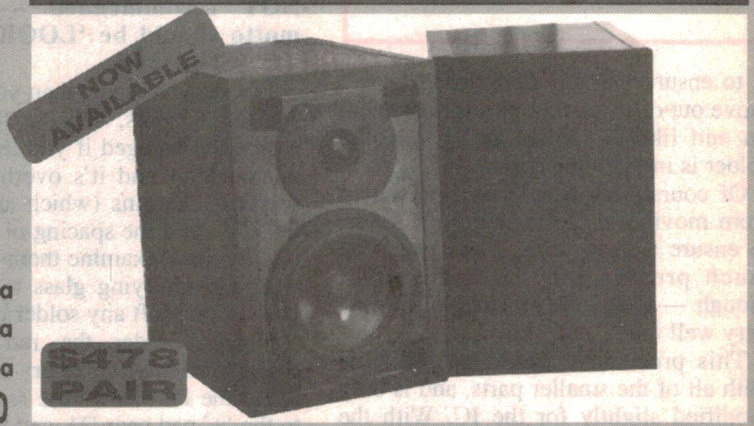

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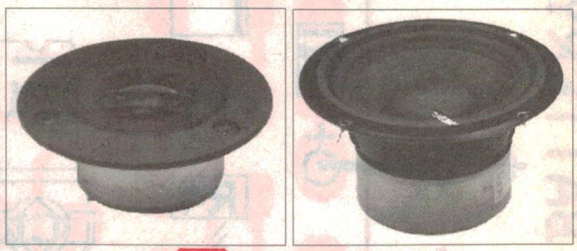

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8"	Polycone	120RMS	25LT	20LT	CS-2234	$65.00
8"	Carbon Fibre	120WRMS	25LT	20LT	CS-2242	$99.50
10"	Polycone	160RMS	50LT	30LT	CS-2236	$99.50
10"	Carbon Fibre	160WRMS	55LT	35LT	CS-2244	$149.50
12"	Polycone	200RMS	105LT	67LT	CS-2238	$135.00
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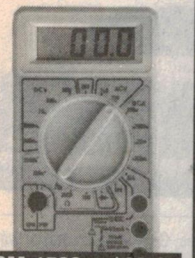

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- Wrap around leads
- Small size
- One hand operation
- Continuity • Diode

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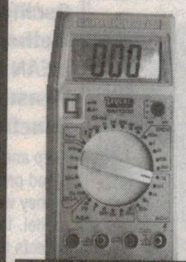
- Transistor Test
- 20 Amp
- Diode Test



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- Capacitance
- Auto Power Off
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NEW

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- 1999 Count
- Data Hold
- Bargraph
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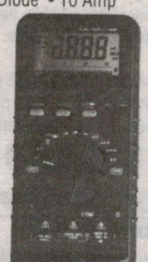

QM-1530 $79.95

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- Transistor/DiodeTest
- Capacitance • Data Hold
- Large Display
- Auto Power Off
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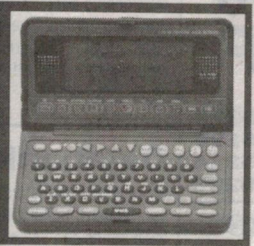

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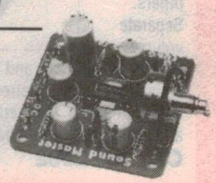

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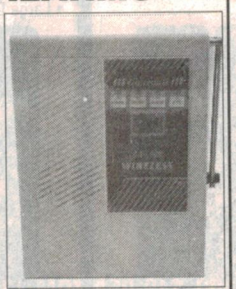

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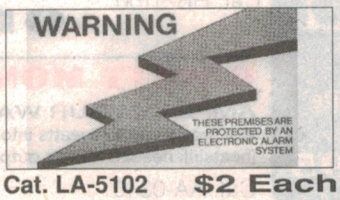

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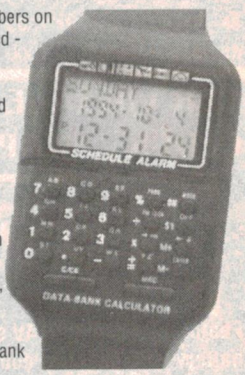

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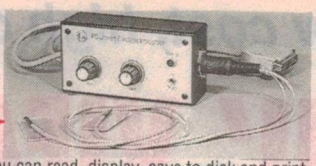

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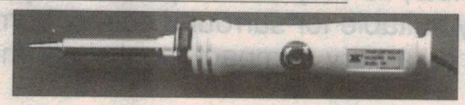

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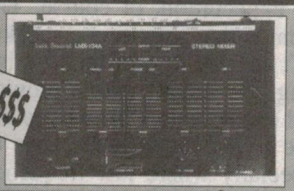

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Assemble your own low cost, high quality

'SUPER MINI' VIFA TWO-WAY SPEAKERS

Here's a do-it-yourself speaker system for those who have very little space to spare, but don't want to sacrifice sound quality. Each enclosure has a volume of only six litres, and features two high-quality Vifa drivers with well shielded magnets, so they can be placed very near TV sets and computer monitors. The speakers are thus very suitable for surround sound 'home theatre' systems, for computer 'multimedia' use, and of course as a very compact 'bookshelf' music system — with or without a subwoofer...

by JIM ROWE

For a long time now, people have been asking us to present the design for a *really* compact speaker system. A bit like the Playmaster 'Bookshelf' speakers we described way back in the 1960's, if you like, only rather smaller again.

Why such a *small* speaker system? Well, people seem to have less space to spare nowadays, for a start. And since most other items of electronic equipment have been compressed in size, they tend to expect that speakers can be shrunk to match — so that like the rest of a modern sound system, they can be relatively inconspicuous. Often there's a need to fit them into a bookshelf, or tuck them into the corners of a room, or squeeze them into a 'multimedia' computer system on each side of the monitor. 1All of which seems a reasonable expectation, of course. The only problem is that shrinking a speaker system isn't as easy as you might think — assuming you still want it to provide good sound reproduction. To a large extent, you're trying to buck the laws of nature: especially where low frequency (bass) sound energy is concerned, things get harder and harder as you make the box smaller.

But it *can* be done, of course. With the right loudspeaker 'drivers' and careful design, it's possible to get surprisingly good reproduction from a very small system.

The main problem in the past has been finding a reliable source of 'the right drivers', at a price low enough to make such a system appealing. However Jaycar Electronics has recently solved this problem, by arranging to stock a number of models in the high-quality Vifa range of drivers, made in Denmark.

Included in the new range are a pair of drivers which lend themselves very well to a really compact system: the M13SG-09-08 woofer and the D25SF-04-06 dome tweeter, both effectively 'shielded' using the double magnet system to reduce their external magnetic fields.

The M13SG driver is described by both Vifa and Jaycar as a nominal 5" woofer, although it has an effective piston diameter of very close to 100mm. It features a cast magnesium alloy basket, a 344-gram magnet and a coated curvilinear cone, with a soft high-damping rubber roll surround. On the performance side it has a nominal impedance of 8Ω, a sensitivity of 88dB (1W/1m), a free-air resonance of 54Hz, a well-controlled response to about 5kHz, a Qts (total Q) of 0.35 and a Vas (equivalent air mass) of 12 litres — making it very suitable for use in a compact bass-reflex enclosure.

The D25SF tweeter is a compact unit with a 25mm dome radiator and a high-loss diaphragm for good damping. It features a 'butterfly' voice coil (whatever that may be), has a nominal impedance of 6Ω, a moving mass of 0.3 grams, a sensitivity of 89dB (1W/1m) and a fairly smooth response from 3kHz to beyond 20kHz. These characteristics make it a good match for

the M13SG, especially in a very compact two-way system.

Realising the potential of these drivers for use in a very small system, and knowing how much appeal such a system would have, Jaycar Electronics commissioned South Australian firm Australian Audio Consultants to design the kit system shown here, based on them. And that's how the JV20 system came about.

Impressive performer

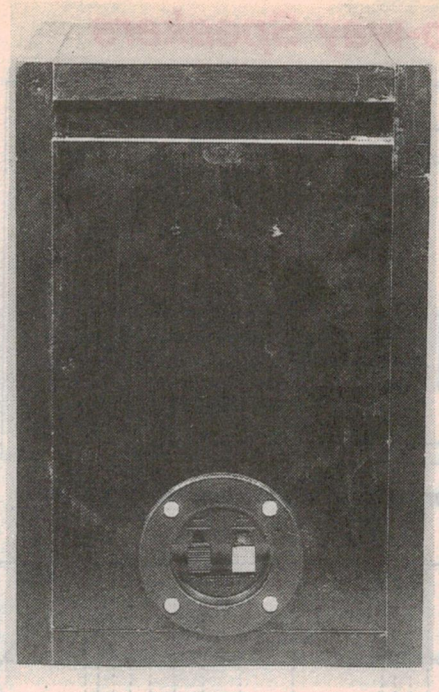
Although we didn't design it ourselves, we're delighted to have the opportunity to present the system here. Our independent tests have shown the JV20's to be very impressive performers; despite their tiny size, a pair of these enclosures can deliver surprisingly smooth and clean 'big speaker sound' — even without a subwoofer. This makes them very suitable for use in a compact 'bookshelf' music system.

Teamed up with a subwoofer, like the same firm's JV80 kit system presented in our June issue, they can form the basis of an even more impressive system. Of course their very small size, coupled with their use of well shielded drivers, also makes them very suitable for use as the 'centre front' speaker in a surround sound or 'home theatre' system, or as a replacement for the rather mediocre speakers supplied in most 'multimedia' computer systems.

We tried them with a couple of computer systems, and they certainly provided much cleaner and better balanced sound than the original speakers. They're also very well shielded, with virtually no external magnetic field to disturb the CRT (cathode ray tube) of a TV set or monitor.

However part of the price you pay for better reproduction is that they *are* less sensitive than the usual el-cheapo speakers. So for best results (read 'decent volume'), you'll probably want to drive them from one of the mini stereo amplifiers with at least 10W/channel output, rather than directly from the sound card itself with its nominal 2W/channel 'flat out'.

Needless to say, the JV20's are also very suitable for the 'rear' channels of a surround sound system. Their quality of reproduction will tend to be much better than that of the rear speakers suplied with many surround systems, while their size is still compact enough to make them easy to 'hide' in the corners of the room. In short, they're very nice little speakers indeed, with a lot of potential uses. And the best part is that you can assemble them yourself with minimum hassle, thanks to the way that Jaycar is selling the kits.



As you can see from this rear view, the tuning port is formed as a gap between two parallel back panels.

Rather than selling them as a pair of enclosure kits, Jaycar is making the JV20 kit available in a way that allows you to build any number you wish. A set of drivers (tweeter and woofer) for a single enclosure, complete with crossover network, polyswitch speaker protectors, rear terminal plate, 'innerbond' acoustic damping material and mounting screws, is available for only $169.50 (Cat. No. CS-2580).

For the boxes, you have a choice of two approaches. If you have the time, energy and facilities, you can build your own, using the dimensioned drawing shown in this article as a guide. Alternatively Jaycar is stocking pre-assembled and very nicely finished boxes, which are available for $79.00 each (Cat. No. CS- 2582). The boxes are finished in 'blackwood' veneer, and come with a dress grille panel with acoustically transparent black cloth, which attaches to the front of the box using Velcro fasteners.

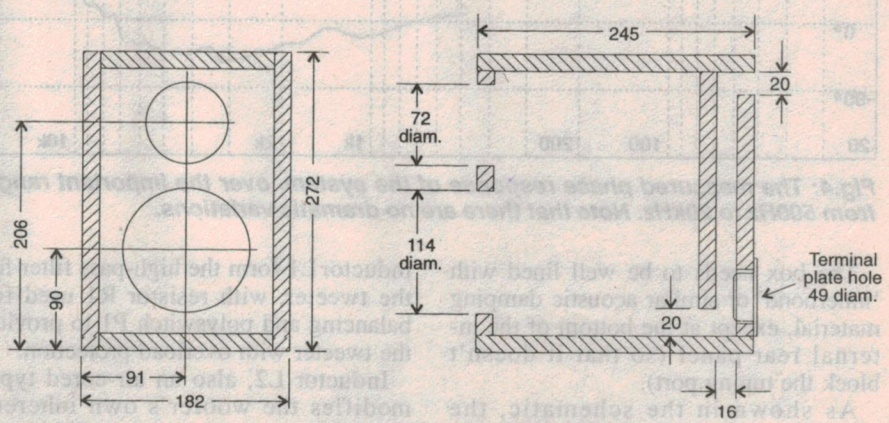
If you decide to buy both the driver/internals kit and the box kit together, Jaycar will sell you the combination for only $239 — an attractive price, considering the quality of these systems. Doing things this way, you'll end up with a complete mini stereo speaker system for only $478.

Compact design

The JV20 is a two-way bass reflex design, with an internal volume of six litres and the tuning port at the rear, to allow the smallest possible frontal area. The port is in fact formed by the gap between a pair of rear panels, the outer panel having a 20mm gap at the top, and the inner panel a similar gap at the bottom.

As the panels are 16mm apart, they therefore form a 'folded' port with a cross-section roughly 150 x 16mm, and a length of about 200mm. This is much longer and larger in area than could be achieved with a standard 'tube' type port, in such a small box.

The basic internal volume of the box is around 6.7 litres, but the driver magnet assemblies, crossover network and front panel mounting cleats tend to bring the effective volume down to around the six litre mark, tuned to a nominal 55Hz.



TIMBER: Custom wood / MDF, 16mm or more

All dimensions in millimetres. External measurements assume 16mm timber

Fig.1: Use this diagram as a guide in making your own boxes for the 'Super Mini' system, if you prefer to do this rather than buy the ready built boxes from Jaycar.

'Super Mini' VIFA two-way Speakers

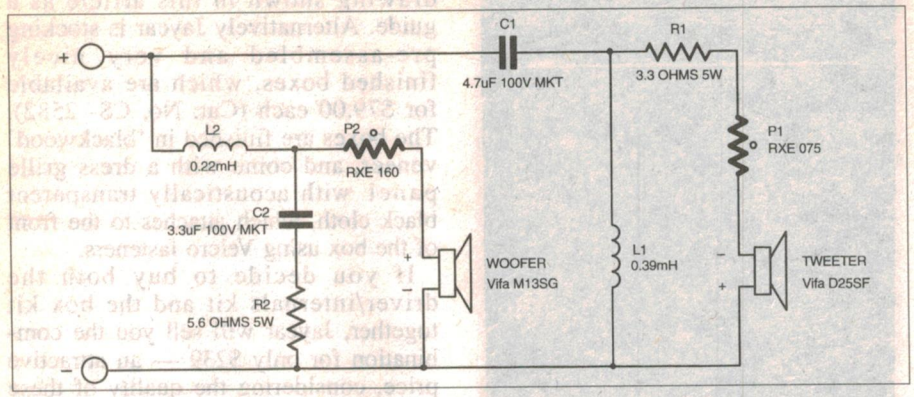


Fig.2: Here is the circuit for the crossover network in the 'Super Mini' system.

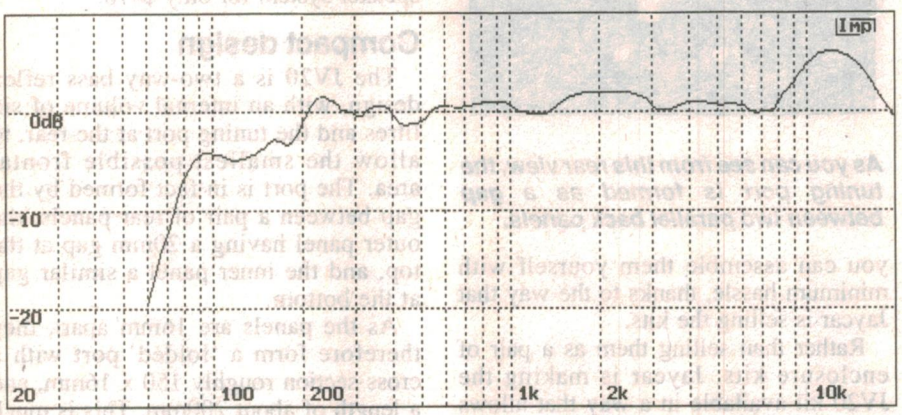


Fig.3: The measured frequency response, which as you can see is commendably smooth from 200Hz to about 8kHz. The bass response is better than this plot suggests, due to measuring difficulties. There's a peak of about 6dB around 12kHz, but the 'brightness' this causes can be trimmed with your treble control.

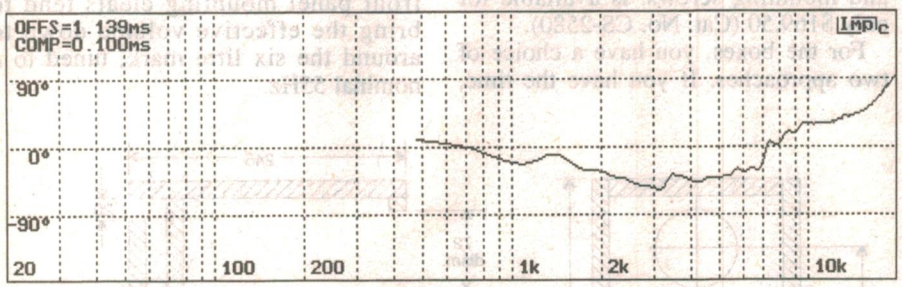


Fig.4: The measured phase response of the system, over the important range from 500Hz to 20kHz. Note that there are no dramatic variations.

The box needs to be well lined with 'innerbond' or similar acoustic damping material, except at the bottom of the internal rear panel (so that it doesn't block the tuning port).

As shown in the schematic, the crossover network is of the Linkwitz-Riley second order type, with a 12dB/octave rolloff slope, and a nominal crossover frequency of 3.5kHz. Capacitor C1 and air-cored inductor L1 form the high-pass filter for the tweeter, with resistor R1 used for balancing and polyswitch P1 to provide the tweeter with overload protection.

Inductor L2, also an air-cored type, modifies the woofer's own inherent low-pass characteristic to achieve a matching 12dB/octave acoustic rolloff slope. Capacitor C2 and resistor R2 form a Zobel network, designed to counteract the woofer's rising electrical impedance and ensure correct crossover action.

The final component is polyswitch P2, to provide the woofer with overload protection.

The terminal plate is mounted centrally at the bottom of the outer case rear, with the wires entering the box proper via the gap at the inner end of the tuning port. As the port has a large cross-sectional area, this causes no problems — as long as the terminal plate is carefully fitted and has sealing compound under its flange, so that there aren't any 'leaks'. In that sense, it needs to be treated in much the same way as the drivers on the front panel.

Assembling a JV20 system using one of the pre-built boxes is very quick and straightforward, involving little more than screwing the terminal plate and crossover network into the box, fitting the innerbond damping material, soldering the wires to the speaker drivers and then screwing the drivers to the front panel.

What we found

Normally, like many reviewers, we tend to run a speaker system through the 'objective' instrument tests first and then do the listening tests. However due to circumstances, we did the tests on the sample JV20 speakers in the reverse order — listening tests first, and measurements later.

Perhaps this was fortunate, in a way, because we had no prior knowledge of the speakers when we tried them out with a reference amplifier and playing our standard CD test tracks. All we knew was that they were very small boxes, and I guess we weren't expecting more than 'nice little speakers' sound...

Frankly, we were very pleasantly surprised. On track after track, we discovered that the JV20's produced a very smooth, extended and quite well balanced sound, with real evidence of the 'boxy' effect often found with very small systems. There seemed to be a bit of extra 'brightness' or upper-treble emphasis on some tracks, and consequent slight exaggeration of any 'edginess' present in some recordings, but that was about it.

The bass performance in fact seemed surprisingly good, considering the sound was coming from boxes with a volume of only six litres. Why, we could even hear (and feel) the pedal notes in a couple of organ recordings, down at frequencies that we would only have expected to hear from a somewhat larger system!

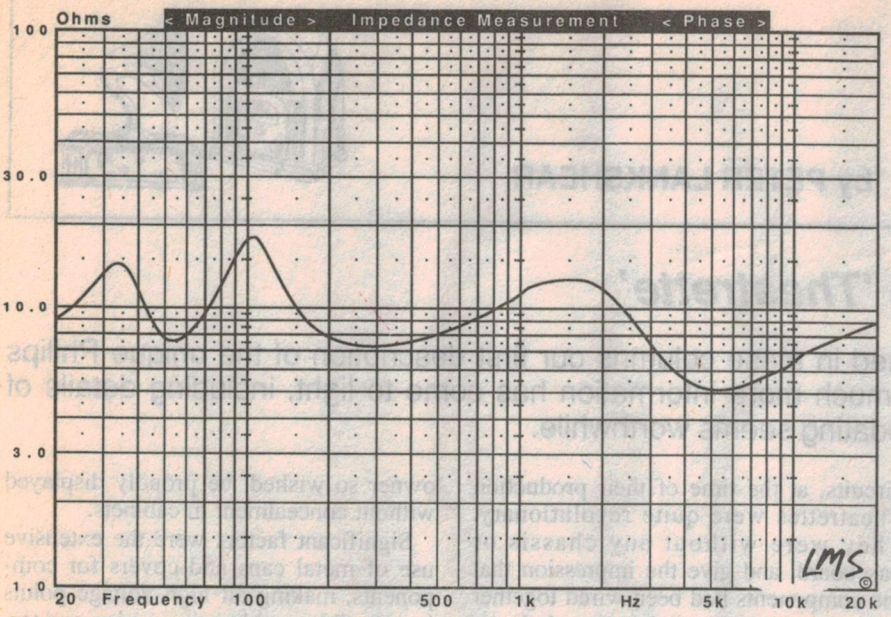


Fig.5: The measured electrical impedance of the system. Although there's an unusual dip around 5kHz, this shouldn't cause any problems with most modern amplifiers. Otherwise, its a fairly standard nominal eight ohm system.

Thus encouraged by the listening tests, we were most interested to see how the JV20's performed in the instrument tests.

Checked out with our IMP loudspeaker measurement system, we soon found out why the speakers sounded so smooth and clean. As you can see from the frequency response plot, the on-axis response is commendably smooth in the critical centre region, from below 200Hz to about 8kHz or so. The 'bumps and dips' are very minor, and for most listeners would be quite inaudible.

There is clearly a rise at the top end, reaching a peak at about 12kHz, and this explains why the speakers sound a bit 'bright'. However the peak is relatively modest, at around 6dB, and the response then falls away relatively slowly as you can see. There are no dramatic movements in the phase response in this region, so it's not a major problem. Many people like this kind of 'bright' sound — and in any case if you don't, it's relatively easy to bring the top end down a little by judicious use of your amplifier's treble tone control.

By the way, don't take too much notice of the shape of the frequency response plot below 200Hz. The room we carry out the IMP tests in is fairly small, and it's not possible to prevent reflections from disturbing the apparent response at low frequencies. The plot was also made with the system well away from any walls, where there was no bass lift due to the interaction of the rear port and walls or floor. In a typical room situation, the bass response is somewhat better than it looks in the plot, being fairly flat to about 100Hz and with quite useful output down to around 45 - 50Hz.

We turned to our LMS speaker measurement system to check the electrical impedance of the JV20's, and as you can see it's quite respectable for a nominal 8Ω system. Instead of the usual steady rise above 500Hz, there's a rather unusual dip down to around 5Ω at about 5.5kHz, but this shouldn't cause any problems for the vast majority of modern amplifiers.

Summary

In short, then, the Jaycar/Vifa JV20 'super mini' kit speaker system is an excellent little performer, with a quality of reproduction that compares very well with much larger and more expensive systems.

So if you want an easy-to-assemble kit speaker system that not only 'delivers the goods' but at the same time is small enough to fit into a crowded bookshelf, computer system or 'home theatre' room, it would make a very good choice indeed. Teaming up two or more of the JV20's with one of the JV80 kit subwoofers would give you a system that would *really* give many commercial systems a run for their money!

You'll find the JV20 kit system in any of the Jaycar Electronics stores. ❖

Mini Booster Amp

Continued from page 63

of high-frequency noise at the amp's output, which judging by the waveform and frequency appeared to be caused by interference from the PC's switchmode power supply. In practice however, this aberration was quite inaudible through the speakers.

Other than that, we checked out the input impedance and sensitivity of the two signal inputs ('low' and 'high' level) at their respective connectors, and the effect of the tone controls on the amp's overall frequency response. Here, the low-level input offered a sensitivity of 500mV (for 1W output into 8Ω) and an impedance of 1k, while the high-level input is rated at 1V into 2k. Clearly, there appears to be a simple 1k/1k voltage divider involved here...

While investigating the tone control action we found that with the controls in the 'flat' position the amp exhibited two broad peaks in its frequency response; one centered at around 35Hz and the other at about 20kHz.

This appears to be intentional 'tweaking' of the response, as this effectively creates a very broad *dip* in the response around 1kHz, which certainly improves the sound of most small low-cost speakers.

And to further enhance or tame the response of the speakers and program source, both the bass and treble controls offer adjustment between a boost of 12dB or a cut of 9dB at their respective ends of the audio range.

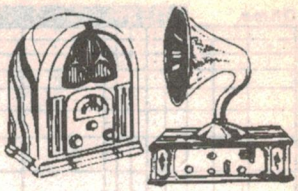
In practice the amp performed well and delivered a robust and clear sound through the speakers, provided they were of a reasonable sensitivity, and is a considerable improvement over the audio stage fitted to most sound cards — which of course also need quite sensitive speakers. It seems to handle 4Ω loads with ease by the way, and generated little heat during our performance tests.

The amp and its associated parts are packaged in a 'upgrade kit' which contains everything all you'll need for the installation job, including a rudimentary (but adequate) instruction leaflet. The kit supplied for this review even included a set of mini 'inner-ear' type headphones — or is that 'in-your-ear' headphones?

The AMP-001 upgrade kit is priced at $69.95, and is available from Rod Irving Electronics stores around Australia (Cat No. A20220). (R.E.) ❖

Vintage Radio

by PETER LANKSHEAR



Revisiting the Philips 'Theatrette'

It is seven years since we published in these columns our first description of the unique Philips 'Theatrette' receiver. Since then, much more information has come to light, including details of Australian models — so that an updating seems worthwhile.

The intriguing Philips 'Theatrette' receivers, along with their Australian clones, were made in at least three countries during the period 1936/39 and are today found in collections from Britain to Australia, and from Brazil to New Zealand.

Their special character comes not from any electronic innovation — their circuits being quite conventional — but from a novel cabinet and internal construction, which has earned them the reputation of having some of the most unsightly wiring of all time.

To anyone used to standard valve radio construction, the first sight of the interior of a Theatrette can be a little unnerving. Although by the end of the valve era metal chassis were giving way to printed circuits, at the time of their production Theatrettes were quite revolutionary. They were without any chassis or baseboard, and give the impression that the components had been wired together on the workbench and then the whole assembly strung around the sides of a shallow box. As we shall see, this was, with refinements, just how they *were* made!

There were two major philosophies in the mechanical design, construction and layout for valve radios. Radios without cabinet backs tended to have chassis with externally clean lines and a tidy outward appearance. In fact, the chassis of some receivers, notably the American McMurdo Silver and Scott, and the Australian Reliance York, with their chrome-plated metalwork, could, if the owner so wished, be proudly displayed without concealment in cabinets.

Significant factors were the extensive use of metal cans and covers for components, making all high voltage points inaccessible, and keeping wiring and terminals under the chassis — so that with the advent of single ended valves, there were often no external wires visible.

Other manufacturers especially in England and Europe, and to some extent in Australia, protected the rear of receiver cabinets with fibre-board backs, so that neatness and appearance of the internals were not a priority. As a consequence, there was often little incentive to conceal wires and cables along with their terminations. Brackets and other add-on fittings often contributed to an untidy appearance, which could be hidden behind a back. From the point of view of the collector, cabinets with backs have the advantage of keeping dust, dirt and rodents out, but they can warp and shrink with age.

Although their receivers were efficient, Philips were firm believers in having backs on their radios and they made their share of the untidy variety. But the ultimate example was their Theatrette series, with major components, including valves, mounted at various angles, on brackets and pillars spaced around the four sides of the cabinet. Coils and IF transformers were even fastened to their mountings with pitch! Small components were supported only by the wiring, which was bunched at strategic points and bound with black electrical tape.

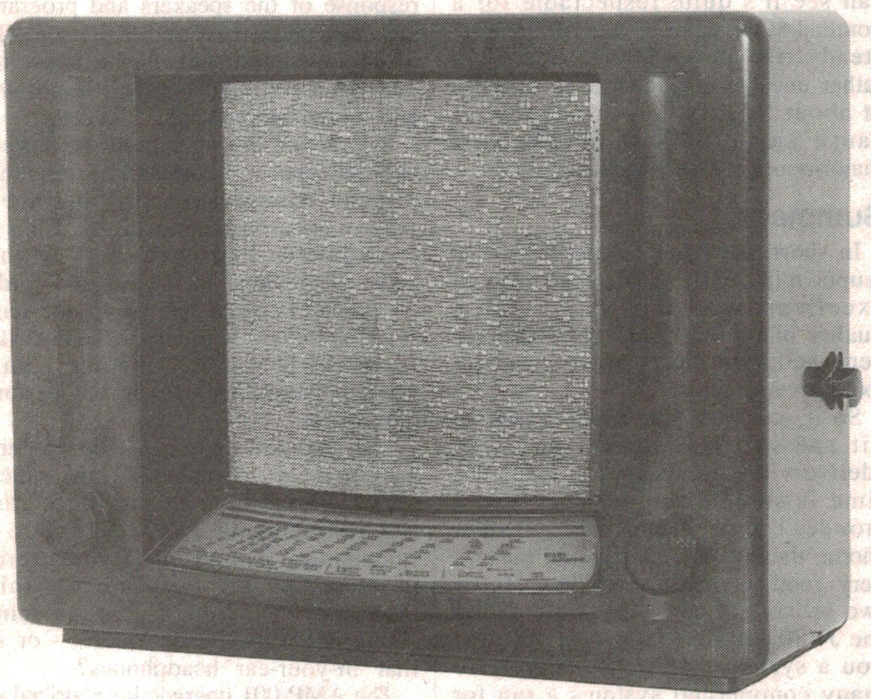


Fig.1: The distinctive cabinet of the aptly named Theatrette was quite unique. With a depth of only about 150mm and a large speaker, acoustic quality was, for an economy receiver, very good.

Low prices

Cost saving was the reason for this radical departure from proven and traditional construction practices. By the mid 1930's, radios were becoming a standard appliance in many homes, and there was an increasing demand

for low priced models, of which the best known example was Nazi Germany's 'People's Radio'.

In Britain, Philco actually called their budget priced receivers 'People's Sets' and one, their 1936 long and medium wave three- valve-plus rectifier Bakelite cased Model 444 superheterodyne, sold for a modest six guineas. Philips' answer was the similarly priced Theatrette, which, as a bonus, had a shortwave band in addition to the usual longwave and broadcast coverage and an extra valve.

Cost governed the size of economy receiver cabinets, usually restricting them to five or six-inch loudspeakers and a small dial. Further savings were possible, as in the Philco 444, by eliminating the first audio valve and driving the output pentode directly from the detector diode.

With the Theatrette fitting into a compact and shallow 'Philite' plastic cabinet which would have used little, if any, more material than conventional cabinets, Philips had space for a generous eight-inch speaker and a full sized five valve, three band superheterodyne. With its superior acoustic and electronic specification, the performance of the Theatrette was the equal of much more expensive models.

Accommodating an eight-inch speaker using a conventional layout would have required a relatively large cabinet. However, significant space savings can be made by surrounding a centrally located speaker with the other components. Although rarely used for domestic radios, this technique was used in some car radios, and a related method was later to be adopted widely in TV sets, with the neck of the picture tube projecting through the centre of a vertically mounted chassis.

Equally innovative was the Theatrette dial. With conventional mounting, a flat scale of reasonable size would have added height to the cabinet and would have been less stylish. Instead, a relatively large curved dial, with calibrations to suit the geographical area where it was to be used, was angle mounted at the bottom of the cabinet below the curved speaker grill.

The result was a unique and eye-catching radio that the name 'Theatrette' fitted most appropriately, for a little imagination shows the cabinet forming a proscenium, the dial a stage apron, and the plain grille cloth a curtain.

Here then was an efficient, triple band receiver with a large loudspeaker and of innovative appearance — hardly the recipe for a competitively priced economy model. Clearly, to keep the

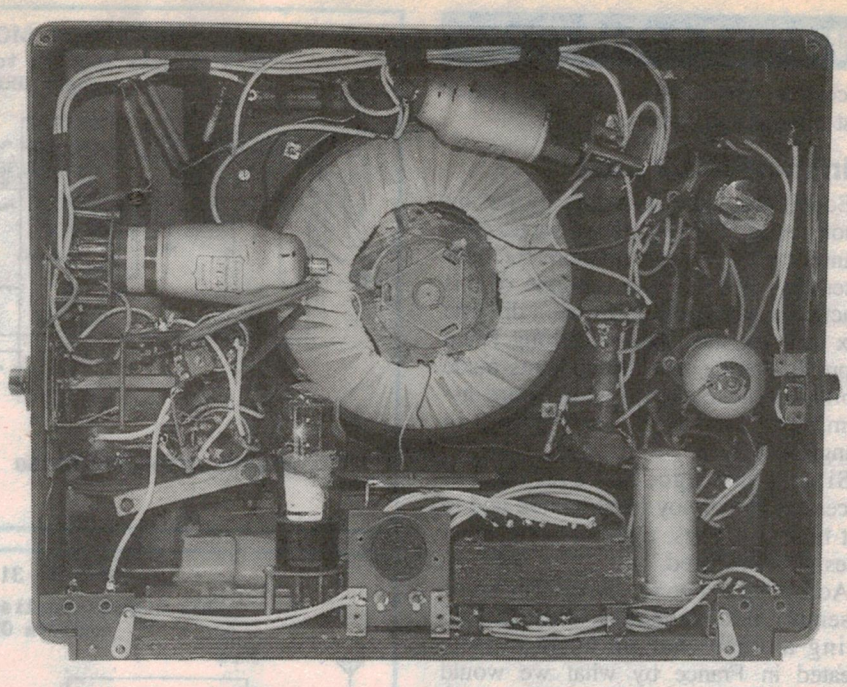


Fig.2: Although the interior of this British built V7A may look very rough, the excellent performance of the Theatrette was in no way compromised, and the well ventilated construction probably contributed to their reliability.

PHILIPS THEATRETTE MODELS

MODEL	YEAR	COMMENTS
V4A	1936	Made in France "Pionnier" 4 volt side contact (P base) valves, AK2, AF3, ABC1, AL3, AZ4.
V4U	1936	AC/DC model 200 ma filament side contact valves
V5A	1936	English model. Mullard range of 4 volt 7 and 4 pin valves FC4, VP4B, TDD4, PENA4, 1821
V5U	1936	AC/DC . 200 ma series filament valves
V6A	1936	French made "Matador" and "Junior" 4 volt, P base valves AK2, AF3, ABC1, AL4, AZ4.
V6U	1937	AC/DC. version of V6A. 200 ma filament side contact valves.
V7A	1937	English made. Similar to V5A plus tone control. Valves 4 volt, 7 & 4 pin bases Mullard FC4, VP4B, TDD4, PENA4, 1821
V7U	1937	AC/DC. 200 ma series filament valves. 7 & 4 pin bases FC13C, VP13C, TDD13C, PEN36C, CY1C.
30	1938	BRITON. Australian made. Dual Wave. 5 Octal valves EK2G, 6U7G, 6B6G, EL3G, 5Y3G. Magnavox E.M.Speaker
31	1938	BRITON. Australian made. Broadcast only. 4 Octal valves EK2G, 6B8G, EL3G, 5Y3G. Magnavox E.M.Speaker
32	1938	BRITON. Australian made. Broadcast only. Battery powered valves. KK2, KF3, 1K7G, 1F4.
	1937	MULLARD. "Westminster" had different cabinet. In New Zealand, Mullard Model 2 listed as equivalent to Philips V7A. Data for Model 2A shows side contact 4 volt valves.

price low, there had to be some major cost savings somewhere.

Minimal labour cost

Economies were possible by paring labour costs. Today, to keep wages low, manufacturers can go offshore for their assembly work. (As an example of this practice, I have in front of me a diskette box carrying the label of a Hong Kong supplier, stating that the contents made from Japanese components were assembled, certified and tested in Bangladesh!)

Sixty years ago, however, it was necessary to employ local labour, and to cut time and costs, rigorous work practices were enforced.

According to one report, the Theatrette assembly line techniques were created using a somewhat inhuman system created in France by what we would now call a time and motion study expert, one Charles Bedaux. With every second of assembly time important, the appearance of the out of sight wiring was not going to be of much concern, and by using the unconventional construction of the Theatrette, Bedaux's method was successful.

A close inspection suggests that the components were first wired together, doubtless on some sort of a bench-top jig. Then the whole assembly was installed in the cabinet, with large components screwed to pillars or standoffs and with tuning and IF coils stuck into recesses specially moulded into the cabinet. Further cost savings were made by the reduction of as much metalwork as possible, although the Australian versions did have additional shields for the IF transformers and two of the valves.

Few other designers before or since have been prepared to resort to such extreme economies, but in the case of the Theatrette it all came together. While the sight of unprotected coils in the British and European versions, and of components supported by wiring may upset conservative technicians, the average prospective buyer would not have known about them or been concerned if the interior, which would not be seen anyway, was unconventional. Far more important were reasonable price, stylish external appearance, performance and reliability. The Theatrette had all these qualities in good measure.

Many variations

At least a dozen variations of the Theatrette were made over a period of about three years. For the British and European Philips series, there was a pattern in the model numbering. All had a V prefix, followed by a single digit and the suffix A for AC operation, or U for AC/DC transformerless models.

There were Mullard versions, but detailed information is limited. The 'Westminster' had a somewhat different cabinet facia, and its dial was more rectangular than that of the Theatrette.

The original Theatrettes were quite conventional superhets with an octode frequency mixer, a pentode IF stage and diode/triode detector and first audio stage, followed by a high gain pentode driving the loudspeaker. There was, though, an unusual power supply configuration in the AC models — which used a half-wave power transformer.

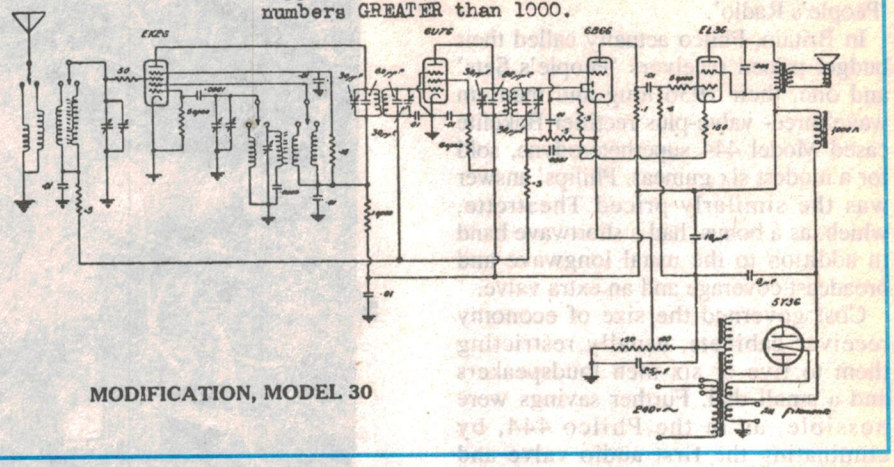
This was possibly done to reduce power transformer winding time, as a centre-tap of the HT winding was not required, with only half the number of turns. The same gauge of wire could be used for both primary and secondary. This approach did, however, require extra iron in the power transformer core. This comes about from there being a DC component flowing through the windings of half-wave transformers.

An interesting story is told of the early production the AC/DC Theatrettes, which used a type C1 barretter (consisting of an iron wire in a hydrogen atmosphere) to regulate the current through the series-connected valve filaments. Inexplicably, the barretters began to fail prematurely, and eventually it was found that the magnetic field of the current flowing in the iron wire reacted to the leakage field from the speaker magnet, causing sufficient vibration to fracture the wire. The remedy was to angle-mount the barretter, further away from the speaker.

To simplify longwave tracking, the original Theatrettes had an intermediate frequency of 128kHz. Consequently, images were separated from the fundamental by only 256kHz. With this small difference, a single tuned circuit ahead of the mixer is insufficient to prevent 'double spotting' of strong signals, even on the broadcast band.

BRITON 30 MODIFICATION

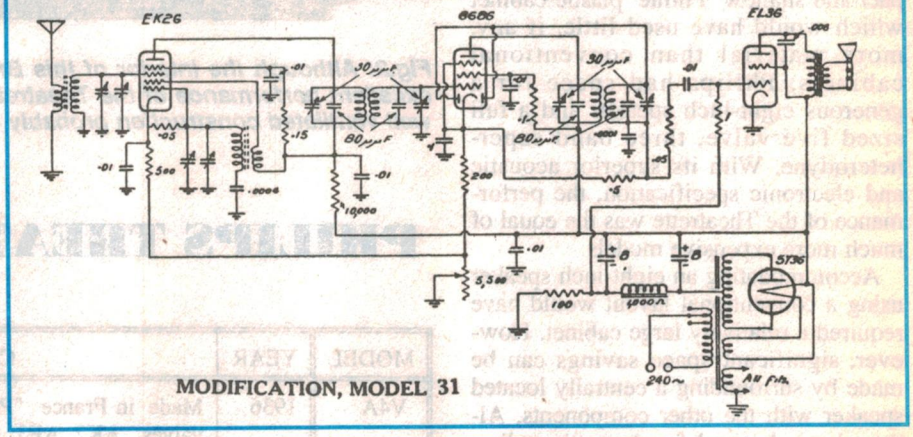
This circuit applies to Model 30 with serial numbers GREATER than 1000.



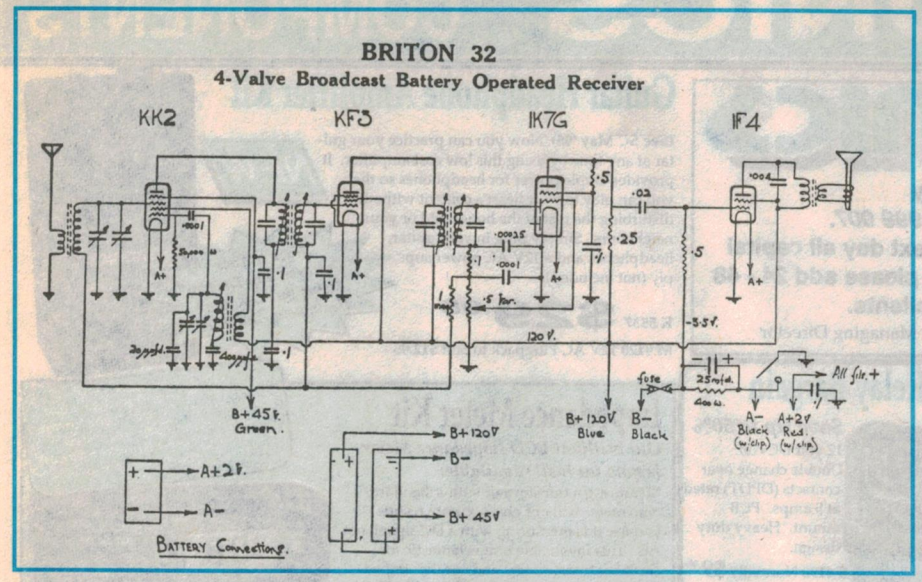
MODIFICATION, MODEL 30

BRITON 31 (MODIFICATION)

This circuit applies to Model 31 with serial numbers GREATER than 500.



MODIFICATION, MODEL 31



Opposite at top: The dual-wave Briton Model 30 was the Australian equivalent of the three band European models. Chassis with serial numbers below 1000 used a 6F6G output valve.

Opposite below: A budget priced version, the Model 31 was a three/four valve broadcast band only set, with a single audio stage. Chassis serial numbered below 500 used a 6U7G IF valve and an EBL1 diode/pentode output stage.

Above: The model 32 was also a single band set, and with two volt filament valves, the only battery powered Theatrette.

As was commonly the practice, this problem was overcome by including a second tuning coil and variable capacitor section switched in for the broadcast band. There was no attempt to minimise this effect on the shortwave band, with the result that each transmission appears in two places. This is, of course, a problem in varying degrees in most domestic shortwave receivers.

Australian production

In 1938, production moved to Australia. Although the original Philips moulding dies were probably imported for use in local presses, the three Australian Theatrettes had white control knobs. These Australian models, identified by simple two-digit numbers, had the 'Briton' brand name, and it is likely that they were made in the Briton plant which had been taken over by Australian Philips. An alternative brand name of 'Aristone' was used for receivers sold by Melbourne's Myer Emporium.

Although good value for money, at 16 guineas ($33.60) for the model 30, the Australian Theatrettes were not as low priced as the European originals. For one thing I doubt if the more extreme practices of the Bedaux assembly line system would have been acceptable in Australia!

Although the European models were all fundamentally similar, there were three distinctly different Australian versions. The circuit of the Model 30 was basically the same as that of the parent Theatrettes, although with different valves and component values. Ray Kelly has pointed out that that the model 30 Theatrette and the first version of the contemporary 1938 Australian Philips 1052 have practically identical circuits.

However the Briton 31 circuit was simplified, with the omission of shortwave coverage and the first audio stage. These economies were reflected in the list price for the type 31 of 12 pounds, nineteen shillings and six pence ($25.95) and the circuit had more than a passing resemblance to that of the *Radio & Hobbies* 'Little General' described in our June and July 1992 column.

The model 32 was quite different from the other Theatrettes, in that it was battery powered and fitted with two-volt filament battery valves.

The two mains powered sets had full-wave rectification and Australian Magnavox speakers, with electromagnetic field windings that doubled as filter chokes. With no Australian longwave broadcasting to cater for, the five valve model 30 was dual mediumwave broadcast and shortwave, and the other two were broadcast band only.

An IF of 462.5kHz was used, eliminating the need for bandpass tuning and a third section to the tuning capacitor. With this higher frequency IF system, shielding of the transformers became necessary, and further metalwork was needed for the American style valves — which had close fitting 'Goat' shields.

The data table summarises the information about the various models that is so far available. With so many different versions produced over a period of four years, it is obvious that the unconventional construction of the Theatrette did not adversely affect its popularity with purchasers.

The European sets were fitted with the four-volt 'Golden' range of valves. Continental models had the Philips side contact series, while the British made sets were equipped with the standard Mullard four- and seven-pin based valves. In line with Australian practice at the time, the Briton Theatrettes used a mixture of valves, including Philips side contact and octal, and American style with octal and even a five-pin based battery pentode.

Special servicing

Overhauling Theatrettes requires a different approach from more conventional receivers. Access is very difficult with the wiring in place. The easiest method of servicing is to unscrew the power transformer and valve sockets one side at a time, and pull the wiring and components out of the recesses to work on them.

The speaker cloth is likely to have picked up dust and dirt. If there is not too much deterioration, it can be cleaned using an aerosol upholstery cleaner, but it is a good idea the remove the grille frame first. This is easily done by first removing the four small screws around the interior of the speaker open

Continued on page 91

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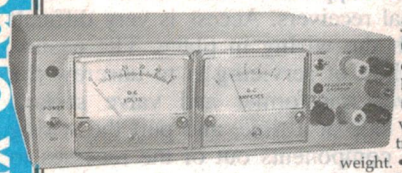

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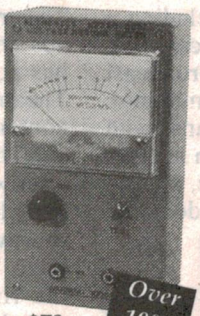

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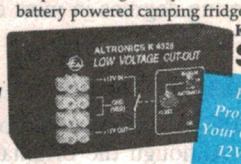

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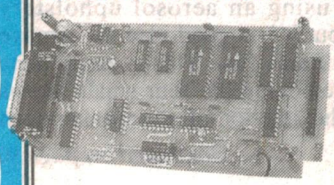

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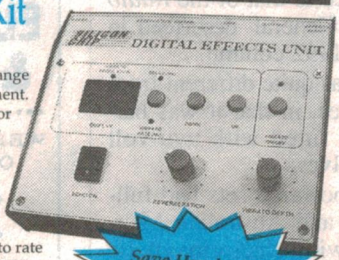

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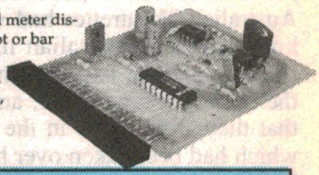

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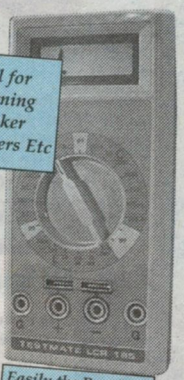

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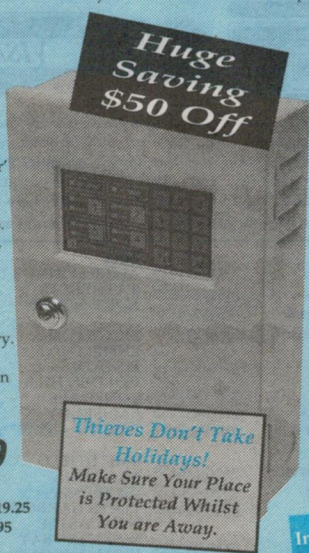

The deluxe S 5485 4 sector alarm panel features a user selectable 4 digit pin number allowing you to arm and disarm the alarm via the inbuilt digital keypad. By using 'End of Line Resistor' technology, all 4 independent sectors accept almost any type of sensor (Normally Open and Normally Closed). Any sector can be individually isolated, (e.g. when at home you may want to turn on perimeter sensors, allowing movement inside). Includes a 24 hour panic and tamper sector. Alarm pre-warning reminds you to disarm on entry. Constructed in sturdy steel case with lock. Includes easy to follow installation instructions.

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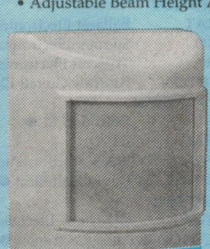

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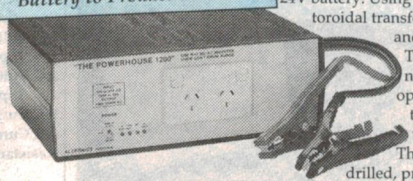

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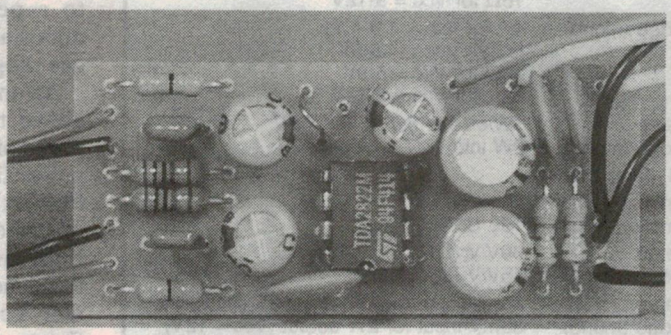
DSE 'Discovery Series' Construction Project:

MINI STEREO AMP

Dick Smith Electronics continues to release further 'learn while you build' project kits in its Discovery Series. The latest project is this tiny single-chip stereo amplifier, with an output of 1W per channel (or 2W mono, in bridge mode). All components mount on a printed circuit board only twice the size of a postage stamp. The complete kit for the project is available from DSE's stores (Cat. No. K-2806) for $12.95.



Without resorting to surface-mount devices, this general purpose stereo amplifier achieves a surprising performance in a small package of roughly 50 x 20 x 15mm.

It is especially suited for battery or low voltage applications, or where space is limited. By means of a single wire link, it can be configured for either stereo amplification of up to 1W output per channel or bridge (mono) amplification of up to 2W output, without heatsinks.

For a simple finished amplifier the PCB module can be fitted neatly into a small 'zippy' box (DSE Cat. No. H-2855) without any mounting components, with enough space left for adding a 9V battery, a volume control, a power switch and connection sockets. These items are not included in the kit, however, and must be purchased separately.

Single chip

The project is based on the TDA-2822M chip, a dual low voltage power amplifier IC. The two amplifiers in this package have a typical gain of 39dB, which is set by the two internal feedback resistors illustrated on the circuit diagram.

The non-inverting (+) input and inverting input (-) of each amplifier have different characteristics. The non-inverting inputs have an impedance of 100kΩ and must be provided with a DC path to ground, for correct DC biasing. On the other hand the inverting inputs have an impedance of about 600Ω, because of the internal feedback network, and have an internal bias source that does not require any external DC path.

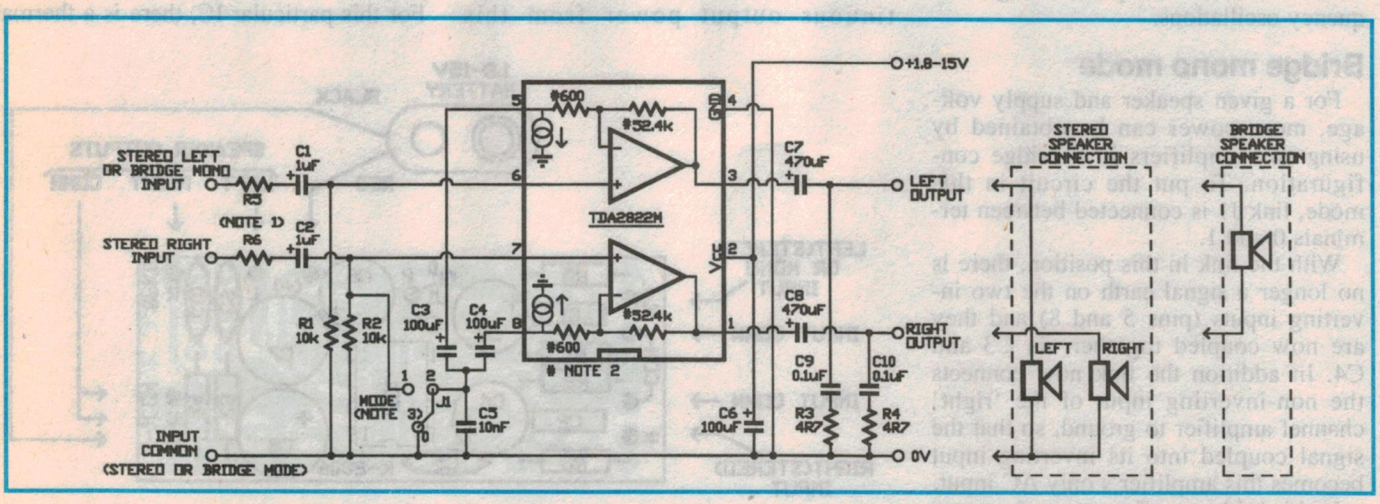
The output stages of each amplifier are of the class B type, and are internally biased for a quiescent output voltage of about half the supply voltage.

Stereo Mode

To set up the project as a stereo amplifier, link J1 is connected between pins 0 and 2. With the link in this position the two amplifiers are isolated and a signal ground is placed on the two inverting inputs via the two 100uF capacitors C3 and C4. The left and right channel signals are fed into the non-inverting inputs via R5 + C1 and R6 + C2 respectively.

Capacitors C1 and C2 are used to prevent any DC voltages that may be present at the inputs from disturbing the biasing of the amplifiers. The 10kΩ resistors R1 and R2 provide the biasing path for the amplifiers, and also provide some loading for the signal source.

The purpose of resistors R5 and R6 is to allow the input signals to be attenuated, if necessary, by forming volt-



The amplifier uses a single IC — the TDA2822M, which provides two separate power amplifier channels. With the very small number of additional parts used here, it can deliver either 1W per channel in stereo mode, or 2W mono in bridge mode.

Specifications

Dimensions	49 x 22 x 15mm	
Power supply	voltage range	1.8-15V
	quiescent current	7mA at Vcc = 9V 4mA at Vcc = 3V
	operating current	320mA for 1W/ch (8Ω, 9V) 180mA for 150mW/ch (4Ω, 3V)
Frequency response	stereo mode	50Hz - 130kHz
	bridge (mono)	70Hz - 20kHz
Recommended minimum speaker impedance	stereo	4Ω for Vcc = 1.8-6V 8Ω for Vcc = 6-9V 16Ω for Vcc = 9-12V
	bridge (mono)	4Ω for Vcc = 1.8-4.5V 8Ω for Vcc = 4.5-6V 16Ω for Vcc = 6-9V 32Ω for Vcc = 9-12V
Max power output at 10% THD	stereo	1W/ch into 8Ω at Vcc = 9V
	bridge (mono)	2W into 16Ω at Vcc = 12V
Peak output current	1A (each channel)	
TDA2822M thermal resistance	Junction-case	70°C/W
	Junction-ambient	100°C/W
Voltage gain	stereo	89V/V (39dB)
	bridge (mono)	45V/V (33dB)
Sensitivity	stereo	30mV input for 1W/ch output (Vcc = 9V)
	bridge (mono)	80mV input for 2W output (Vcc = 12V)

age dividers in conjunction with R1 and R2 respectively. For example, if R5 and R6 are made 100kΩ this will produce an attenuation of R1/(R1+R5) = 1/11, which should suit the signals from portable CD players, headphone outputs, etc. The kit is supplied with '0' ohm resistors for R5 and R6, to give no attenuation and hence maximum gain from the amplifier channels.

Because the amplifier outputs are at a DC potential of about Vcc/2, the speakers are connected via 470uF coupling capacitors C7 and C8. Output shunting components C9/R3 and C10/R4 are used to prevent high frequency oscillations.

Bridge mono mode

For a given speaker and supply voltage, more power can be obtained by using two amplifiers in a bridge configuration. To put the circuit in this mode, link J1 is connected between terminals 0 and 1.

With the link in this position, there is no longer a signal earth on the two inverting inputs (pins 5 and 8) and they are now coupled together via C3 and C4. In addition the link now connects the non-inverting input of the 'right' channel amplifier to ground, so that the signal coupled into its inverting input becomes this amplifier's only AC input.

In this bridge configuration, the mono input signal is applied to the left channel input. It then appears in amplified and non-inverted form at the output of the 'left' channel amplifier, but because a fraction of this output is then fed back to the inverting input of the 'right' channel amplifier, the latter then produces an inverted but almost identically amplified version of the same signal.

By connecting the load (our speaker) between the two amplifier outputs, it is therefore fed with approximately twice the peak voltage, giving a potential of four times the peak power possible from the individual amplifiers in stereo mode. However due to power dissipation considerations, the actual continuous output power from this configuration is only about twice rather than four times the single amplifier output, unless a heatsink is added.

Optimising power output

To get the most out of the amplifier IC, it is important to understand its limitations. Assuming that there is enough input signal voltage available, there are three limits to the amount of audio power available from the amplifier.

The first and most obvious is the supply voltage, which limits the output voltage swing of each amplifier to a peak-to-peak value of Vcc — minus about 1V due to the internal voltage drops.

Attempting to drive the amplifier above this limit simply results in the peaks of the signal being 'clipped'. This power limit is given by:

$Po(max) = (Vcc-1)^2/(8 * R_L)$

in stereo mode, where R_L is the AC load impedance, and the factor of eight in the denominator is to take into account that Vcc is effectively a peak-to-peak figure, whereas power is proportional to the RMS voltage.

In mono bridge mode, the equivalent expression is

$Po(max) = (2Vcc-1)^2/(8 * R_L)$

Secondly, the absolute maximum peak output current must not exceed one amp, or the IC will be damaged. To prevent this limit from being exceeded, the lowest value of speaker impedance (R_L) that can be used is given by:

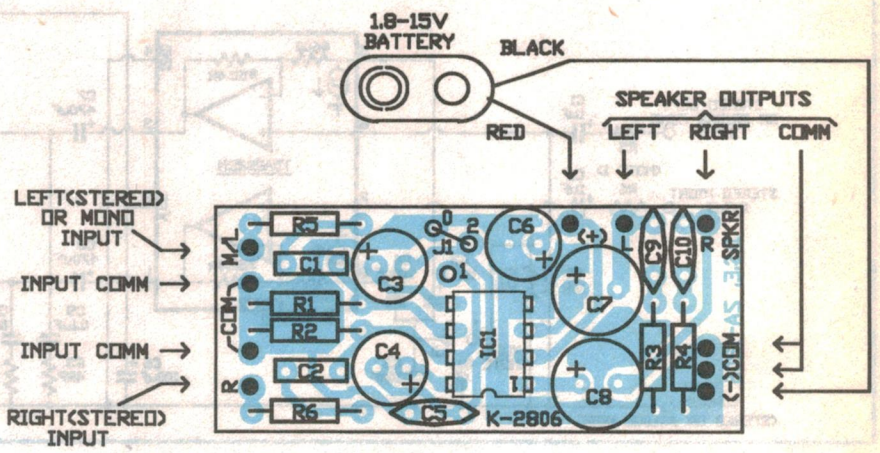
$R_L(min) = Vcc/(2 * Imax) = Vcc/2$

in stereo mode and

$R_L(min) = Vcc/Imax = Vcc$

in bridge mode.

Thirdly, the IC can also be damaged if the temperature of the semiconductor junctions within the IC exceeds 150°C. For this particular IC, there is a thermal



As you can see from the overlay diagram, everything fits snugly on the PCB. The main thing to watch is that the polarised parts are fitted the correct way around.

resistance between the semiconductor junctions in the IC and the outside surface of its case (θjc) of 70°C per watt, and between the junctions and the air (θja), without a heatsink, of 100°C per watt.

Thermal resistance (θ), temperature (T) and power (P) are analogous to electrical resistance, voltage and current respectively, and are related by the following formula:

$T = \theta * P$

Using this formula, which is analogous to Ohms Law, the junction temperature of the IC can be calculated. If you are familiar with Ohms Law, then the diagram of Fig.1 will aid in calculating thermal conditions. Note that Pd is the power being dissipated, Tj is the junction temperature, Tc is the case temperature, and Ta is the ambient temperature.

Pd, the total power dissipated by the IC, has a maximum value given here by:

$Pd(max) = 2 * Vcc^2/(2\pi^2 R_L)$

in stereo mode, and

$Pd(max) = 4 * Vcc^2/(2\pi^2 R_L)$

in bridge mode.

This is a general formula, applicable to class B amplifiers and assumes negligible quiescent power dissipation. By calculating Pd, and measuring either Tc or Ta, the IC junction temperature can be calculated using:

$Tj = Ta + (\theta ja * Pd)$, or

$Tj = Tc + (\theta jc * Pd)$

For example, let Vcc = 9V, $R_L = 8\Omega$, Ta = 25°C and θja = 100°C/W.

Then in stereo mode:

$Pd(max) = (9)^2/(\pi^2 * 8)$

$= 1.03W$

$Tj(max) = 25 + (100 * 1.03)$

$= 128°C$

since the junction temperature is less than 150°C, the IC will not be damaged.

PARTS LIST

Resistors

(All 1/4W 5% carbon film)

		Colour Code
R1,2	10k	Bro Blk Ora Gold
R3,4	4.7 ohms	Yel Vio Gold Gold
R5,6	0 ohms	Blk

Capacitors

C1,2	1uF 25V monolithic ceramic (105)
C3,4,6	100uF 16VW RB electrolytic
C5	10nF 50V ceramic (103, .01)
C7,8	470uF 10VW RB electrolytic
C9,10	0.1uF 50V ceramic (104, 100n)

Semiconductors

IC1	TDA2822M dual low voltage power amp

Miscellaneous

Printed circuit board, 49 x 22mm, code ZA1206.

Construction

Construction of the mini amplifier is fairly simple, with all the components being mounted on a single printed circuit board (PCB) measuring 50 x 21.5mm and coded ZA-1206.

To place the components, look at the overlay diagram which shows how the components and wire link (jumper J1) actually appear on the PCB. Read the label of the component, e.g., 'C1', from the overlay and then look up the description next to that label in the parts list. For example, C5 is a ceramic type capacitor and it has the value 10nF; the actual component may be marked either '10n', '0.01uF' or '103'.

Begin construction by installing link J1 and resistors R1-6. The resistors have their values marked on them as a colour code, which is given in the parts list. The last band of the colour code gives the tolerance value, and is the one furthest from the others.

Resistors can be mounted in either direction, but it is good practice to mount them with their colour codes all in the same direction for ease of reading the values later.

Remember that two of the resistors supplied with the kit, R5 and R6, are actually wire links. They have the appearance of 1/4W 5% carbon resistors, but have a nominal 0 ohm resistance, and on the overlay they are shown as resistors. These are used in place of wire links, because they are easier to install than wire links and make the board look more tidy. They also allow replacement with higher-value resistors, if you need to attenuate high-level input signals to prevent overload of the amplifier.

Next, mount the integrated circuit IC1. The IC has a notch at one end, which is shown on the overlay diagram.

Now mount the smaller capacitors C1, C2, C5, C9 and C10. These are all non-polar types and so can be mounted in either direction. One thing to note when identifying a capacitor is that the value can be marked on it in different ways — for example '103', '10n' and '.01' are all the same value and are shortened notations of 10,000pF, 10nF and 0.01uF respectively.

Next mount the electrolytic capacitors C3, C4 and C6-8. These are all polarised capacitors, which will have a negative (-) or (+) sign printed on them (normally the negative lead is marked); they must be mounted in the direction shown on the overlay. Some of these capacitors have kinked leads, and these should be straightened out with a pair of pliers so that the capacitor can be mounted with its body in contact with the PCB.

With the assembly of the board complete, carefully check all the soldering. Look especially for dry solder joints, and solder 'bridges' shorting tracks together.

If all seems well, your Mini Stereo Amplifier should be complete, and ready to hook up in either stereo or mono bridge mode, to begin work. You'll find it a very handy little unit.

Adding a heatsink

To decrease the operating temperature of the TDA2822M, the best method is to solder a copper sheet to the PCB track connected to pin 4 (GND) of the IC. Alternatively a small heatsink could be glued to the IC package. ❖

VINTAGE RADIO

Continued from page 85

ing. One screw is hidden behind the second IF transformer.

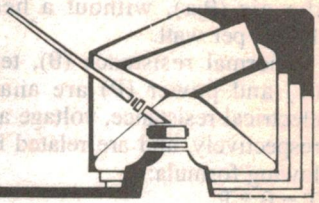
Bakelite is a more durable material than wood, but even so the cabinet will probably need some hard work. Old furniture polish, especially the silicone variety, can be especially tenacious and difficult to remove.

Use non-abrasive household cleansers and a soft cloth; Brasso can also be useful for rubbing down scratches and dull patches.

Well, there it is. If being different and successful makes a radio collectable, then the Theatrette must be one of the most desirable ever. It more than achieved its purpose, in that it proved to be a good performer, sounded very well, was inexpensive, had eye appeal and was reliable. The Theatrette might have been the butt of some rude comments, but it certainly was good value for money.

Finally, thanks are due to Roger Johnson, Darryl Kasch, Ray Kelly and John Stokes, for making available valuable information and data. ❖

Information centre



Conducted by Peter Phillips

Insect repellers, repair hints and more

We look at a few 'issues' this month, including commonly held beliefs about electronic gadgets, and the effect of harmonics on the power generating system. There's also the usual range of questions, comments and general information.

I'm sure most people would agree that technology has made an incredible impact on our lives, to the point where many people accept that if it's a 'hi-tech' product, it's likely to be pretty fantastic.

These days many 'technologically advanced' products are either claimed to be, or are electronic. This has given rise to quite a few beliefs, like these:

(1) If it's electronic, it's able to do whatever the maker claims.

(2) If it's claimed to be electronic, it is — especially if it has a battery.

(3) A device can be electronic without needing a battery or a power source.

I'm sure most readers have seen examples of what I'm talking about, or at least glossy advertisements for them.

I'm prompted to make these comments for two reasons: they fit in with the first letter I'm presenting, and because a pensioner friend of mine has just wasted about $100 purchasing a number of devices claimed to silence barking dogs. This same friend has since ashamedly shown me a range of other gadgets he has bought over the years, all claiming to do things I knew (and he has since found out) were impossible.

Here's our first letter, then, which is about a gadget we would all like to believe works.

Is it a phoney?

I have been interested to note in recent times an increasing number of advertisements for ultrasonic pest repelling devices. These devices operate in the 30kHz to 60kHz range, and are claimed to repel a variety of insect and rodent pests. How effectively do these devices work, and are they available in a kit form? Paul van Pinxteren, Stafford, Qld.)

If we believe the many claims about ultrasonics, Paul, it seems we have a panacea to most of the world's irritants. Switch on an ultrasonic transmitter and suddenly dogs stop barking, mosquitoes keep their distance and rodents vacate the premises. But is there a vestige of truth in all this?

About 20 or more years ago, *ETI* published an ultrasonic mosquito repeller project that struck a chord among readers. As I recall, the article claimed that the female mosquito was particularly sensitive to the frequency transmitted by the ultrasonic transducer used in the project. It all seemed reasonable, so like many others, I built one. But did it work? Unfortunately no, although some might argue it reduced the number of mosquitoes seeking my blood.

As far as I'm aware there is little or no real evidence that a low power ultrasonic sound repels insects, or that it repels anything for that matter. However, if anyone can send me research results to the contrary, I'd be glad to publish the details (and to build the device that gives the results).

While I'm on this topic, let's look a bit further at some of these gadgets, starting with dog 'silencers' or repellers. A typical claim is because a dog has such sensitive hearing, it will stop barking or run away when exposed to the high frequency sound of an ultrasonic transmitter.

While it might be true that dogs can hear a 30kHz signal, the small 9V battery (which is the typical power source of a commercial unit) surely can't provide enough power to make this sound irritating to a dog. Our family's dog is quite content to endure my sound system blasting out many watts of sound, so it's hard to believe it will be greatly affected by a high frequency sound source of far less power.

The device might be useful as a training aid, like a whistle; but unless the power output is greatly increased, it can't be a useful dog deterrent, or stop a neighbour's dog from barking.

Another type of dog trainer (repeller) is one that emits a very loud but audible high frequency sound. Obviously such a device is effective in drawing a dog's attention, or scaring it: but making it do anything (like stop barking) is surely a matter of training, not doggy intuition. Possibly useful, if you and those nearby can stand the noise!

And finally there's those 'electronic' appliances that don't need a battery. I was so intrigued by the claim made by an advertiser of an 'electronic antenna' that I bought one, especially to see what was inside. The electronics is a printed-circuit board and two resistors. The track pattern looks technical and the resistors are real. But, if this is electronics, then perhaps the term needs redefining. A few basic tests confirm the device has about the same performance as any internal TV antenna.

If you have information about other types of electronic gadgets that don't meet the advertised expectations, let me know. I'll be happy to present your comments, as this is something I'm sure many people will be interested in.

Disagrees about CFLs

The next letter is from a rather disenchanted reader, who disagrees with a letter I presented in April about compact fluorescent lamps (CFLs).

Sometimes I think your letters department and the answers given cause more confusion that assistance. I refer in particular to Energy Savers, Information

Centre April 1995. It's true the Australian harmonic standards are more rigorous than most of the world for CFLs, but for good reason.

Widespread use of loads with high harmonic content causes increased losses throughout the electricity generating network. If the alteration to foreign lamps causes an increase of one watt in consumption, it is justified as it reduces losses almost certainly in excess of this in the supply network caused by wattless current.

As well, the degrading of the waveform by harmonics is a real problem. I recall stories of the harmonic content in a building's wiring system being so large as to destroy the entire neutral conductor in an otherwise balanced three phase system. This problem was caused by the large number of switchmode appliances such as CFLs, computers and photocopiers.

However, I'm confident the addition of 'a larger filter capacitor' is not how CFL manufacturers overcome the problem. The harmonics are caused by the rectification and filtering processes, and the problem becomes worse with increased capacitor size. In fact, it's the size of the filter choke that is increased to tune out and block harmonics generated by the rectifiers.

The reason why some types of CFLs are upset by a square wave supply is the inrush current each time the supply reverses. This causes increased heating losses in the input choke and other components in the input circuit, including the diodes. I doubt the problem has anything to do with the switching speed of the diodes, but is due to the higher power dissipation. In particular, the problem component is usually a safety fusible resistor, which can be replaced.

Regarding inverters, while spikes can also be a problem, you'll find most modern inverters have good spike suppression. The references to the Statpower inverter are a total phurphy. All square wave inverters produce harmonics, or they would be sinewave inverters by definition. Refer to Fourier analysis if you don't understand.

Far from producing any interference, the switchmode types are rife with RF noise, which has to be suppressed. There's nothing wrong with the 'old transformer type inverters' if they are intelligently designed. By the same token a badly designed switchmode inverter will also cause problems.

There is nothing to be gained from spending extra money on a switchmode inverter unless compact size is important. If you have a genuine concern about quality of power, buy a sinewave inverter. I'm sorry I can't say anything nice about your magazine. I think it has become rather boring, particularly the audiophile reports by Louis Challis. (Greg Clitheroe, Rainbow Power Company, Nimbin, NSW.)

I'm sorry you find *EA* boring, Greg; we try hard to make each issue interesting. Naturally I can't let your comments about CFLs and inverters go without a reply, although I don't have any technical disagreement with your letter.

It was the contributor seeking information on powering CFLs from an inverter who referred to the Australian standards regarding harmonics as being 'a bit over- board', not us. If that is his view, he's entitled to it. At no point did we agree, or even comment. As for fitting a larger filter capacitor to reduce harmonics, we can't comment either, as it appears this information came from a CFL manufacturer. If this is wrong, fair enough. In fact I see your point and tend to agree with you, Greg.

The reason we gave for CFL failure when powered from a square wave was supplied by Oatley Electronics, who were undertaking research on powering a CFL from a 12V supply. Based on my knowledge of the field, I agree with their conclusions. For example, I recall in the early days of TV when valve receivers were powered by a solid state bridge rectifier that it was essential to put small capacitors across the diodes unless high- speed diodes were used. Otherwise the diodes would fail — nothing else, just the diodes. In fact, for best economy most manufacturers used conventional diodes and capacitors rather than high speed diodes.

You're obviously quite correct about it being impossible for a square wave inverter to be free of harmonics. I guess I overlooked that part of the letter while preparing the column. Thanks for pointing it out. As for your comments about inverters, I bow to your obviously greater knowledge and just say the views expressed were again the contributor's, not the magazine's.

What?? alert

This is another of my usual calls for What?? questions. I have virtually run out of questions, and I'm seeking your help. If you have a question you think likely to entertain or perplex other readers, then please, *please* send it to me. You'll get full acknowledgment.

Dry cell charger

Here's the first letter I've received about my dry cell battery charger, presented in January 1995. I know the project has been very popular, so the lack of mail suggests the project has given no problems. Good!

Regarding your dry cell charger, my unit performs to the specifications in Table 1, which gives the AC voltage across R10 (3.9 ohms) for different charge currents. However, given that the charge current equals the voltage divided by 3.9, by my calculations this gives a current far less than that specified. Where am I going wrong? (Albert Koeppe, Modbury Nth, SA.)

I should have made it clearer in the article that this voltage is an indicator only, not a way of determining the actual current. The current is not a conventional sinewave, where both halves of the waveform have the same value.

In this circuit, the negative half cycle has a smaller value than the positive half, giving a distorted sinewave. Most AC voltmeters (including the one used to take the measurements) are calibrated for a pure sinewave. So for a non-sinusoidal waveform, the voltage reading of a conventional AC voltmeter is only a guide, not a value that can be used with Ohm's law.

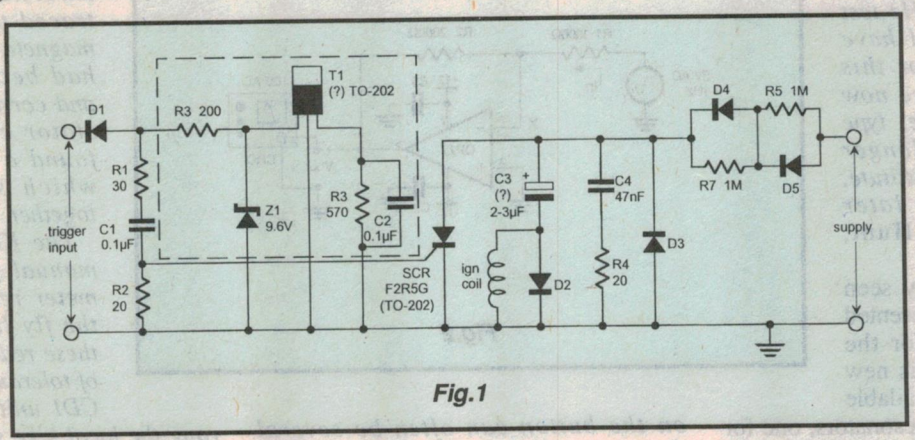


Fig.1

Incidentally, as a result of the discussion we've had recently on modifying old TV receivers to work properly with a VCR, Albert also sent me a copy of an extract from The Serviceman column in *EA* for May 1984, which lists the modifications needed for a range of TV receivers to work with a VCR. So if you are having problems with an old set and a VCR, you might just find your set listed and the necessary modifications. Thank you Albert, and I'm impressed you were able to track this information down after all these years.

Minispot

In February 1981 *EA*presented the design for a small, cheap 455kHz signal source for AM radio alignment. This design uses a Murata filter, type SFB455A, which is now no longer available. This project has proved incredibly popular, even today...

I recently tried to purchase a filter to make the 1981 Minispot 455kHz test oscillator project. I have tried everywhere for this component, and have now found out the device, type SFB455A is no longer made. Is there a substitute, or do you have a later design? (Bruce Hunt, Heathmont, Vic.)

As you've probably seen by now Bruce, we presented an updated design for the Minispot in April. This new design uses readily available ICs and two ceramic resonators, one for 455kHz, the other for 10.7MHz. So apart from using currently available parts, it also gives a 10.7MHz signal source for aligning FM radios.

Varying CD speed

In February, a ballroom dancing teacher (Alan Boulton) asked about varying the speed of a CD player. While the following letter doesn't tell how, it gives information that could be useful:

I would like to pass on some information concerning a variable speed control for a CD player. The ballroom dancing studio I attend uses a modified Technics CD player. The modifications were carried out by Lee Roberts, of 61 Wyong Road, East Keilor 3033. I believe Lee is not able to supply a kit but is willing to carry out the modifications himself.

I understand that old movies like 'Casablanca' have had the sound track re-recorded digitally, so the projection speed can be varied to fit in with television commercial requirements, but without altering the pitch of the sound track. (Peter Chegwidden.)

Thanks for this information Peter, I'm sure quite a few dance studios will be interested. I must say I'm appalled to think the projection speed of any movie, let allow a Bogie classic, is varied to suit advertisements. Is nothing sacred?

Remocon repair

We've had letters about repairing remote control transmitters before, but this next one offers a solution I think you'll find interesting.

Infrared remote control handsets generally use rubber buttons with a conductive coating applied to the contact surfaces, which when pressed give a connection between the tracks of a PCB. The resistance of the conductive coating on the button can often be several thousand ohms and the control will still operate properly.

However the conductive coating can wear off, making the affected function inoperable. This can be confirmed by measuring the resistance across the ends of the buttons with an ordinary multimeter. The faulty buttons will have a much higher resistance than those which work properly, generally those which don't get much use.

The obvious solution is to make the buttons conductive again. I have tried graphite from a dark (2H) pencil, but this works for only a couple of days. My second repair attempt involved the use of conductive copper-filled paint intended for repairing heated rear window strips on cars, purchased from the local automotive supply store.

The product I used is made by Loctite, and is quite expensive ($17) for a (very) small bottle. After cleaning the contact ends of all of the buttons, I applied two coats of the paint, with drying allowed between coats. After reassembly the remote control unit worked reliably, and is still OK more than six months later. Other units have responded similarly. The paint is expensive, and not much is used, but it's still a lot cheaper than a new remote control. (Barry Leslie, Winston Hills, NSW.)

Thanks for this useful hint, Barry. I too have tried all kinds of conductive materials on remote control pushbuttons, and your idea seems the best one I've come across so far.

Kawasaki CDI

This letter seeks information on a topic that hasn't been discussed in this column for quite some time.

I own a 1986 Kawasaki KX-125 motorcross bike, which after a trip through a puddle, decided it didn't want to go. No spark. I traced the problem to the magneto stator coils, which had become waterlogged and corroded. I fitted a new stator coil assembly, but found a very weak spark, which soon stopped altogether.

The Kawasaki workshop manual gives a number of meter readings to make at the fly leads, and three of these readings were well out of tolerance, proving that the CDI unit had failed. I then rang the local bike shop for a new CDI unit, and after regaining consciousness, I vaguely remembered a voice saying $600. The local bike wrecker's quote was just as horrific.

So being an intrepid technician, I thought I would go where no one has gone before: into the bowels of a Kawasaki CDI unit. The unit is potted in epoxy resin so with a heat gun, scraper/screwdriver and a respirator I removed all the resin, cleaned up the components and drew a circuit of the unit.

Now for the problem I need help with. The purpose/operation of the area inside the dashed lines of the circuit comprising T1, Z1, two resistors and C2 eludes me. The only ideas I have are that this part of the circuit is maybe a dwell control system (there is no spark advance, the stator coils are fixed), or some form of pulse shaper. Being unable

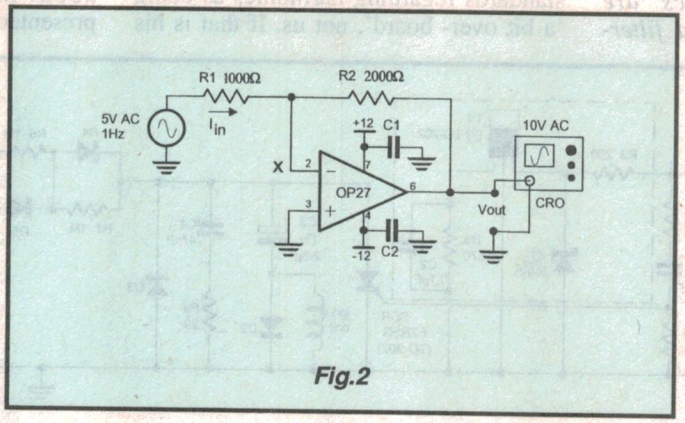


Fig.2

to identify component T1 doesn't make matters any easier. A meter check of T1 shows an open circuit for all lead combinations (I believe this component to be faulty, as all the others have checked out OK).

Wondering why the CDI unit had failed, I bench tested the stator coils to see what sort of voltages they generate. I discovered its output did not match the input required by the CDI unit, and it seems I have been sent the wrong stator coil assembly.

Although it looks identical to the original, the fly lead plug connections are in a different order. Kawasaki change their designs every year, so it's quite easy to mix things up. A trap for the unwary...

I'm going to adapt another CDI unit to my bike but I'm curious as to the function of the circuit in the shaded area. Can you or any of your technical staff come up with any ideas? (Mark Lovell, Forest Hill, NSW.)

The circuit diagram Mark traced out is shown in Fig.1. We can't offer any other purpose for the section in question, and can only throw it over to readers who might be more expert in this field. If anyone can help, please let us know.

What??

Here's an op-amp question from Bryan Maher, who has supplied quite a number of intriguing What?? questions. If you know your op-amps this one is quite easy, but if you don't, you'll find it most educational. Here's Bryan's question, which he describes is more of a Where than a What:

The op-amp in Fig.2 is an 0P27 in phase inverting configuration. Input resistor R1 is 1k and feedback resistor R2 is 2k, so the circuit has a gain of (-)2. The input signal is 5V AC at 1Hz. Therefore the output at pin 6 is 10V AC, as shown by the CRO (with a 10M input impedance) connected to the output.

The power supply is +/-12V, bypassed at the op-amp terminals by C1 and C2, each 0.1uF. Because of the virtual earth effect at X, there is almost zero signal voltage at point X. Therefore the input current (taken from the 5V source) is 5V/1000 ohms = 5mA.

The question is where does this current flow?

It cannot flow into pin 2 of the op-amp, because an OP27 has an input bias current of only 15 nanoamps. Furthermore it does not flow into the CRO from pin 6, because the 10 megohm input impedance of the CRO draws only one microamp. You can show (by placing a differential voltmeter across R1) that 5mA is flowing in R1, but to where?

Even though the virtual earth effect causes almost zero voltage between pins 2 and 3, there is no connection between these points and no current flows between them. But the current must go somewhere, and must eventually reach the ground end of the 5V AC source, as the signal current must flow in a closed loop.

Answer to June's What??

When the voltmeter is connected, the applied voltage of 266V will appear across three neon lamps instead of four, causing them to fire. When this happens, the increase in current in the circuit will cause the voltage across the voltmeter (and N4) to rise sufficiently to cause N4 to fire. Once this happens, the circuit will stabilise with a voltage of 59V across each neon, which is what the voltmeter will read. When the voltmeter is disconnected, the lamps will all remain on, but the circuit current will fall by about 6uA. ❖

Receiver for VNG

Continued from page 49

D). An aluminium or die-cast box would also serve. The variable capacitor must be of good quality, preferably a ceramic insulated air spaced type. In any event, avoid the 'transistor radio' plastic units. If desired, the crystal may be oven controlled as described (for instance) in Ref.2.

To make precise adjustment of the crystal frequency easier, install a planetary (or similar) reduction drive. If the speaker is internal, the capacitor should be connected to the drive through an insulated coupling, otherwise the balls may act like a carbon microphone in series with the alternative ground path for the capacitor, and introduce AF feedback.

To wind broadband transformer T1, take two 300mm lengths of 24B&S (0.5mm) enamelled wire. Twist together at one end and clamp that end in a vice. Twist the free ends together and fix them in the chuck of a hand drill. Whilst maintaining tension on the pair, turn the drill until you have about three twists per 10mm. Give the drill a tug to set the twist, then remove the pair.

Carefully thread the pair onto an Amidon FT50-43 core; about 11 loops should fit nicely. Cut the leads to about 10mm. Remove some enamel from the leads, then with your multimeter on ohms, identify the two 'windings'.

REFERENCES

1. 'DC91 Direct Conversion Receiver' by D. Diamond, in *Amateur Radio*, January 1992.
2. 'A Simple Temperature-Controlled Crystal Oven', by I.L. Pogson, in *Electronics Australia*, April 1987.
3. Booklet: *VNG Standard Frequency and Time Signal Service*, published by the National Standards Commission.

Operation

Before applying power, run your eyes over the boards again and check that all parts are correctly located, and that polarised components are properly oriented. Remember, 'all electronic components are sealed to keep the smoke in — when the smoke escapes, the part is ruined'.

It was hoped that a small loop antenna would suffice for signal pick-up. During development, fairly good reception was indeed obtained at night using a tuned five-turn loop wound upon a rectangular plastic case. However, there was a tendency for the LO signal to get into the RF amp, and reliable operation cannot be assured.

Here near Melbourne (and probably in most other places around this country), a big antenna is not necessary. About five metres of ordinary hook-up wire should provide reliable reception for most of the day and well into the evenings. Interestingly, at night several of the other standard time signal broadcasts on 5MHz can also be heard in the background, including JJY Japan, WWV Colorado and WWVH Hawaii — whose pips may be observed lagging behind VNG due to propagation delays.

Peak the trim capacitor of the input tuned circuit for the strongest signal. Rotate the RF and AF gain controls for a moderately loud output, then adjust the crystal LO variable capacitor to bring the oscillator 'woo-oo-ooo' beat onto frequency as previously described. The LED gives a clear indication of the beat when it becomes sub-audible, and it is particularly handy as an aid to adjustment right down to within 1-2Hz of zero beat.

If the ambient temperature is reasonably stable, any period after 10 minutes warm-up and re-adjust should have the LED showing 'stable-as-a-rock' operation of the oscillator, indicated by a steady glow. You now have an accurate local frequency reference, with precise time information kindly announced every minute.

To gain full benefit from the service, it is suggested that a copy of Ref.3 be obtained. For this write to the VNG Users Consortium, GPO Box 1090, Canberra ACT, 2601. Return postage would be appreciated. ❖

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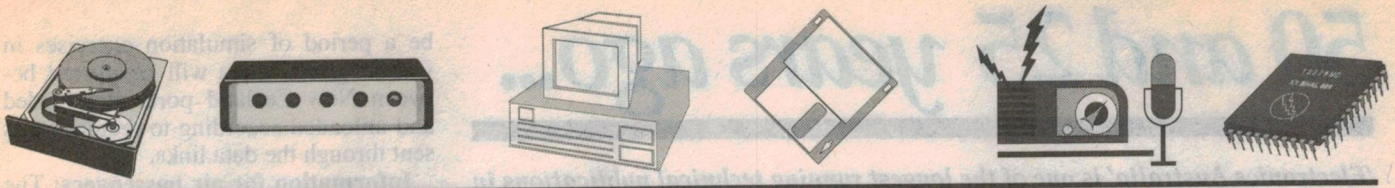

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Catridge and Headshell: to suit Sony turntable model PS-X55. Set of old headphones 2000Ω impedance. Phone (069) 641 677 B.H. or write G. Schubert P.O. Box 2088 Griffith 2680 NSW.

50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Below we feature some items from past issues.

July 1945

Colour pictures by radio: Full colour pictures can now be transmitted by radio with the same speed as black and white photographs. The pictures are sent and received in the form of three colour separation films which are developed and printed in the customary way for making full colour prints.

For transmission, a colour picture is placed on a cylindrical drum for line by line scanning by a phototube. A colour disc, containing triangular sections of the three primary colours — red, yellow and blue —is placed between the scanning eye and the picture. Each colour in turn is filtered out.

The scanner selects and transmits impulses for the three colours, which are recorded in their proper order by the exposure of films on a receiving drum. The technique is basically the same as for sending news photographs or maps by facsimile.

July 1970

Trans-Tasman data link: A high speed data transmission link has been set up in Australia and New Zealand ready for the start of container shipping in that country early in 1971. Standard Telephones and Cables Pty Ltd provided units for similar links between Sydney and the other Australian states before the first container ship arrived. The data link to New Zealand is already receiving information about the likely demand from various centres and the allocation between ports of the 2200 containers which appear likely to be required.

As happened in Australia, there will be a period of simulation exercises in which 'ghost' ships will be moved between New Zealand ports and loaded and unloaded according to requirements sent through the data links.

Information for air passengers: The passenger information system at Sydney's new international air terminal is claimed to be the first in the world to use both complete and abridged presentation. The system includes 2000 loudspeakers, 90 amplifiers (with automatic level controllers), computers, TV cameras and equipment, and 15 flight information boards. A programmed public address system gives information only to the particular areas of interest, such as arrival information to the arrival half only. Passenger holding areas adjacent to the aircraft docking positions are also equipped with individual PA systems.

Announcements are made by a DCA controller who coordinates these with visual announcements displayed on specially designed information boards. The flight displays, at a number of strategic points, give precise information concerning each flight.The displays take the form of large boards which list the airline flight number, origin, destination, schedule arrival and departure times, gate number, etc. ❖

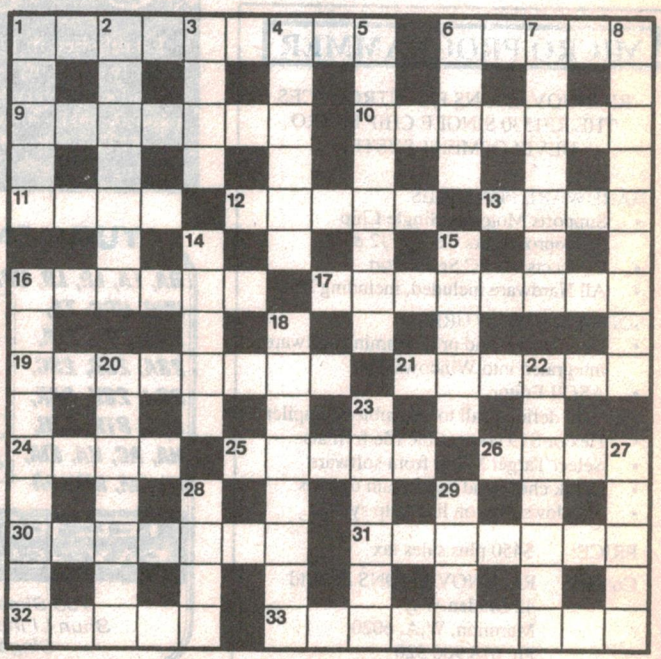
EA CROSSWORD

ACROSS

1. Speaker designed for limited range. (9)
6. Magnetic measure. (5)
9. Exploratory spacecraft. (7)
10. Part of electric heater. (7)
11. Reference line. (4)
12. Detect certain stimuli. (5)
13. Common dimension (abbr.) (4)
16. Unified combination of devices. (6)
17. Name of radiation belts. (3,5)
19. Said of a battery terminal. (8)
21. Said of non-dynamic charges. (6)
24. Part of r.m.s. (4)
25. These are produced by bremsstrahlung. (4-4)
26. Lose operational ability. (4)
30. Cause of wear and tear. (7)
31. Ocean crossed by ANZCAN cable. (7)
32. In 1960, Theodore Maiman developed this device. (5)
33. Pertaining to the applied sciences, etc. (9)

DOWN

1. Prefix meaning above. (5)
2. Study of electronic applications to living things. (7)
3. Half of the binary code. (4)
4. Examples of vectors. (6)
5. Adjustable resistor. (8)
6. Dendritic group of crystals. (4)
7. Modified video production: ---- effects. (7)
8. Concerned with the substance Sb. (9)
14. Prefix indicating thousandth of pico. (5)
15. Joules per second. (5)
16. Fall to significantly lower temperature. (9)
18. Rise to significantly higher temperature. (8)
20. Cosmically induced groups of particles. (7)
22. Volume of communications. (7)
23. Said of vision requiring concave lenses. (6)
27. Type of telephone call. (5)
28. Result of hacking with saw? (4)



SOLUTION FOR JUNE 1995

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Electronics Australia's

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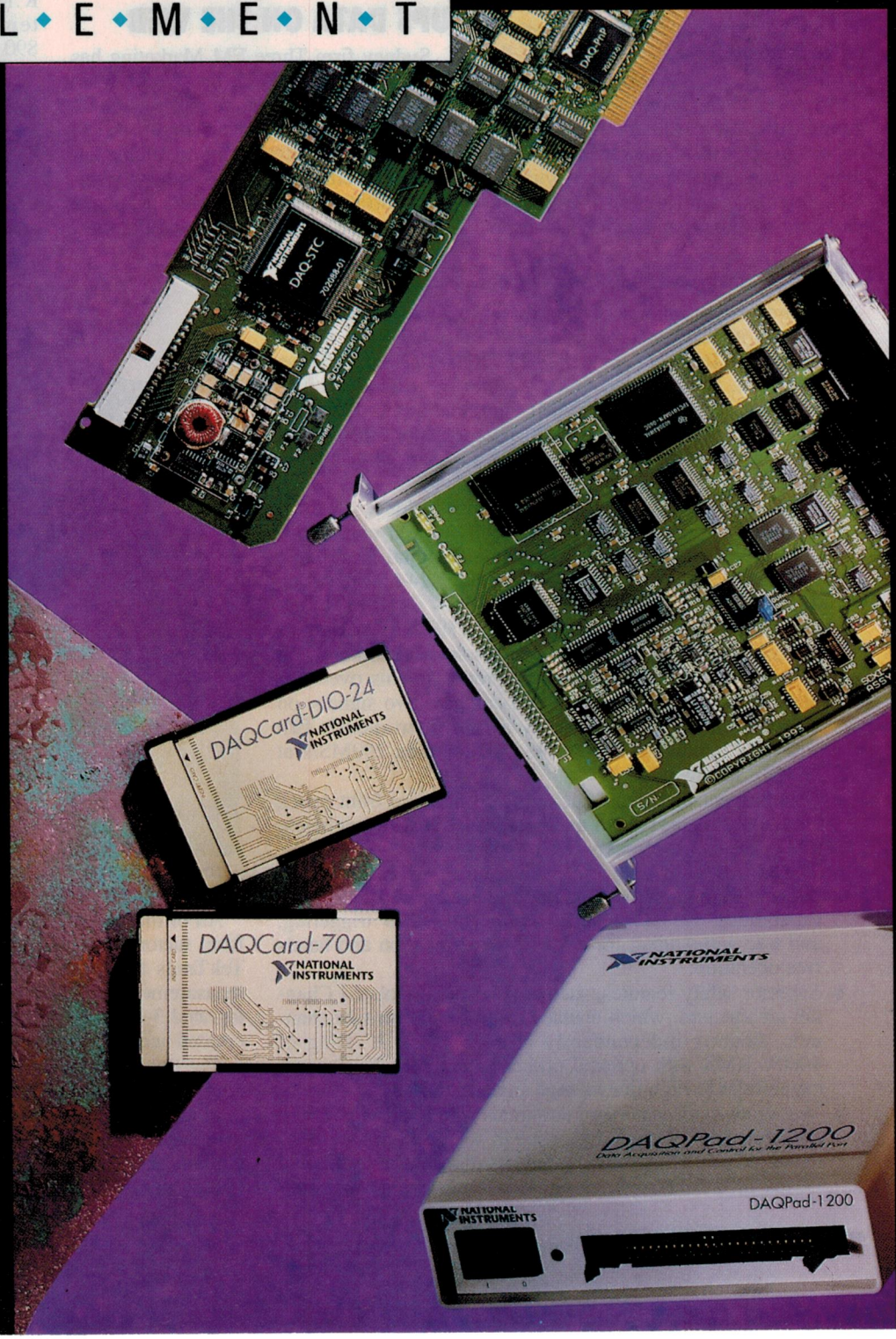
S • U • P • P • L • E • M • E • N • T

TEKTRONIX RELEASES FIRST HANDHELD 100MHZ SCOPE

REVIEW OF MICROGRAFX'S 'DESIGNER 4.1 TECHNICAL EDITION' CAD PACKAGE

DATA ACQUISITION AND CONTROL PRODUCTS FEATURE

JUST A SAMPLE OF THE WIDE RANGE OF DATA ACQUISITION AND CONTROL PRODUCTS FOR LAPTOP, PORTABLE AND DESKTOP PC'S FROM NATIONAL INSTRUMENTS. ALL CAN BE USED WITH NI'S LABVIEW AND LABWINDOWS SOFTWARE, FOR CONVENIENT PROGRAMMING:



NEWS HIGHLIGHTS

COMMITTEE ENDORSES CHANGE TO 230V

Standards Australia committee EL/40 has agreed that it is appropriate for Australia to move towards a 230V supply voltage, and has decided that like the UK, Australia will adopt IEC 38 — the standard which commits Europe to a standardised supply of 230V +/-10% by the year 2003.

However it is recognised that while adopting the 230V standard will assist the export prospects for Australian manufacturers, at the same time the very wide +/-10% tolerance will present a significant problem for those manufacturers — especially when the additional 'customer installation' voltage drop is taken into consideration. The Australian Electrical and Electronic Manufacturers Association (AEEMA) will be addressing this issue in appropriate forums, both domestic and international.

UPS DATA ON THE WEB

Sydney firm Three EM Marketing has set up a home page on the World Wide Web, providing a range of information on its uninterruptible power supply (UPS) products. The information available includes specification sheets, other technical information and current prices, plus a 'Which UPS' guide to selecting the most appropriate UPS for a given application. Orders can also be placed electronically for any of the company's products.

The WWW address for the TEM home page is:

http://www.magna.com.au/~tem

and further information is available from R.Mathur at (02) 831 6792, email tem@magna.com.au or fax (02) 890 2728.

EATON BUYS EMAIL SWITCHGEAR & CONTROLS

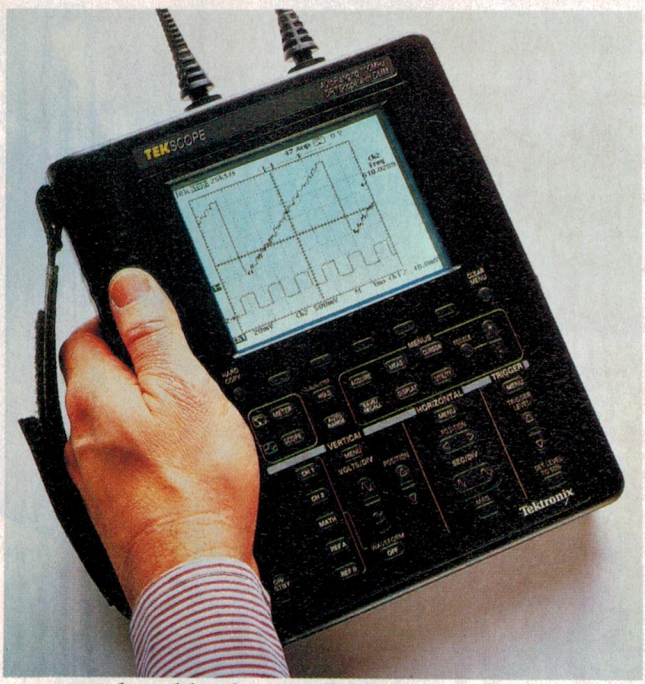
Eaton Corporation, the large international manufacturer of industrial controls and power distribution equipment based

FIRST HANDHELD 100MHZ SCOPE/DMM

Tektronix has announced the newest high performance additions to its TekTools family of electronic handheld instruments — the TekScope, models THS 710 and THS 720. These lightweight, field rugged units are the first digital oscilloscope/digital multimeter (DMM) combinations to offer the high speed and high bandwidth performance needed for quick and accurate troubleshooting of a variety of electronic problems, all at an affordable price.

Features of the TekScope THS 700 series include:

- Unmatched troubleshooting productivity and confidence accomplished by Tektronix' patented Digital Real Time oversampling technology (US Patent 5,144,525) which dramatically reduces aliasing and enables single shot capture at full bandwidth; Both of the THS 720's channels digitise at a rate of 500MS/s, 20 times the acquisition speed of previously available handheld products. This oversampling allows users to capture and compare two signals, on two channels, simultaneously at the instrument's full 100MHz bandwidth. The THS 710 features 250MS/s at 60MHZ bandwidth;
- Usability enhancements, including an intuitive front panel, icon based menu system and back lit LCD with brightness that exceeds that of many CRT displays.
- The ability to trigger on and capture a wide choice of events. Built into the TekScope are advanced triggering capabilities, including pulse width and video triggering, and true autoranging for easy signal acquisition and hands free operation;
- Superior safety features, such as Tektronix' Isolated Channel architecture, which enables safe probing on two channels, floating independently of each other. A rating of 1000V RMS with optional probes extends the TekScope's capabilities to high line voltage signals; and
- Versatility to measure various signals with a fully integrated DMM and 100MHz digital scope in one package. The TekScope has modes to display information like a traditional DMM or oscilloscope, along with 21 automatic measurements selected by the user. TekScope can also store up to 10 waveforms and 10 setups in its memory.



All of this capability is built into a rugged, flat panel, small form factor for high portability, and like all members of the TekTools family, is affordable. For basic voltage, current measurements and data logging, the TekScope also has an integrated 3-3/4 digit, 4000 count DMM with true RMS for increased accuracy.

The TekScope is designed for troubleshooting electronic equipment including medical technology, communications equipment and computer controlled manufacturing equipment. Due to its bandwidth and acquisition speed, it is particularly suited to capturing the high speed signals found in today's microprocessor based systems.

in Cleveland, Ohio, has acquired the electrical switchgear and controls business of Australia's Email Ltd. The deal includes Email facilities in Australia, New Zealand, Singapore and the Philippines which manufacture and distribute a wide range of electrical equipment including circuit breakers, panels, contactors and switchgear. The business has 500 employees, and had sales of approximately US$30 million in 1994.

The largest business unit within Eaton Corp is Cutler-Hammer, a leading manufacturer of industrial controls and power distribution equipment, which currently has annual sales of US$1.6 billion. In 1994 the Corporation also acquired the Westinghouse distribution and control business, and has the rights to the Westing-house brand name. Overall, Eaton has 51,000 employees and 150 manufacturing sites in 18 countries, with annual sales of US$6.1 billion for 1994.

'BIGGER AND BETTER' BRISBANE EXPO 95

The Electrical Contractors Association, Queensland, will hold ELECTRO EXPO 95 at the new Brisbane Convention Centre at Southbank on 1st to 3rd August 1995.

The ELECTRO EXPO series of trade exhibitions and seminars have been held bi-annually since 1985 and have become Australia's leading trade show for the electrical industry. They provide Australian and International manufacturers with opportunities to show the latest technology for electrical installations in mines, factories, offices and homes. Visitors have the opportunity to view, assess, and have personal demonstrations, of the equipment and components on display, by the experts manning the exhibits.

Previous ELECTRO EXPO's held at Boondall, have attracted over 200 displays and more than 5000 visitors have viewed them. The inner city location at the Brisbane Convention Centre with better access and modern facilities is expected to attract many more exhibits and visitors, to make ELECTRO EXPO 95 the largest ever held.

MEMORY CHIPS TO TRIPLE BY 2000

Spurred by chip consumption across a broadening array of industries and applications, the world wide market for memory chips will nearly triple from US$21 billion in 1993, to US$59 billion in the year 2000, growing at a 16% compound annual rate, projects a new study just released by Frost & Sullivan.

By 2000, DRAM (dynamic random access memory) revenues will account for a heightened 67% of total market revenues, SRAM (static RAM) 15%, ROM (read only memory) 7% and flash memory chips 6%, forecasts the report, World Memory IC Market: Processors And Portability Drive Innovation And Growth.

Other segments are eraseable programmable ROM (EPROM) and electrically eraseable PROM (EEPROM).

New industries that historically were not major consumers, including automotive manufacturers and producers of industrial machinery, have been increasing their use of chips, integrating more microcontrollers and related memory devices into their products. Memory chip consumption by these industries will continue to rise as the use of robotics and 'on-board' computers increases.

Semiconductor industry dependence on the computer industry is decreasing as chips are designs into an ever wider range of products. Historically, the computer industry has been the largest end user of memory chips and continues to exert tremendous influence on this market. Other major historic consumers

ADC TO SUPPLY BROADBAND 'PLATFORM'

ADC Telecommunications has won a US$185 million contract to supply Optus Vision with advanced broadband technology for its digital cable network. ADC's Homeworx access platform product will be a major component of Optus Vision's broadband digital network, which will be the world's first to provide broadcast video, telephony and interactive services on the one cable.

Optus Vision expects to run its network past three million Australian homes by the end of 1998. Optus Vision's Chief Operating Officer, Mr Frank Anthony, said: "Our relationship with ADC is an important one. Optus Vision will use ADC's Homeworx access platform to transport telephone and telecommunication services over its network".

"We will also use ADC's broadband connectivity products in our local exchanges to terminate, distribute and cross-connect optical fibre and copper cables," Mr Anthony said. "The Homeworx product was chosen because it is ideally suited to providing telephony services over our broadband digital network and delivering an integrated video, voice and data package to residential and small business customers."

The Homeworx acess platform is constructed from a hybrid fibre/coax architecture. A major benefit is that it enables telecommunications service providers to construct a network which is both cost effective and capable of providing unlimited expansion to accommodate future services. Homeworx delivers telephony and broadband services over a single cable.

ADC Telecommunications recently acquired AOFR Pty Limited, headquartered in Canberra. AOFR is a manufacturer of fibre-optic couplers and components and holds a dominant position in the optical fibre coupler market world wide. AOFR products include singlemode and multimode fibre optic couplers, splitters and combiners, singlemode wavelength division multiplexer (WDM) couplers, singlemode dual wavelength couplers, singlemode attenuators, and fibre optic cable organisers.

AOFR has a large market share of the global fibre in the loop, cable television and test equipment markets. Products like AOFR's fibre optic couplers and WDM devices are being widely deployed by cable television and telephone companies as they build and upgrade their broadband networks. The company has significant customers in North America, Europe and Australia, and its North American customers will now be serviced through ADC Telecommunications Inc.'s direct sales and customer support organisations, based in Minneapolis.

NEWS HIGHLIGHTS

have been the consumer electronics, telecommunications, military and aerospace industries.

CABCHARGE GOES ELECTRONIC

Cabcharge Australia, the operator of the National Taxi Charge System, will introduce a fully electronic payment and processing system during the next two years. In announcing this move at the 1995 Australian Taxi Conference, Chairman and Managing Director of Cabcharge, Mr Reg Kermode, said "The new Cabcharge system will cater for the full range of payment cards as well as the emerging stored value 'smart' cards".

"An integrated approach has been taken in the design and development of the new Cabcharge taxi system. In addition to an on-board taxi terminal that electronically processes fares, other features of the system include a Global Positioning Module to record taxi trip details and, in times of emergency, service as a vehicle tracking system. The Global Positioning Module can also be connected to existing taxi despatching systems," Mr Kermode said.

"A second feature of the system, which enhances driver safety, is an on-board video camera for emergency situations. When activated, this camera relays real time audio and vision to either the taxi network or a central monitoring station."

The integrated taxi system will be piloted as part of the national trial of mobile EFTPOS in taxis, due to commence in July 1995, in conjunction with the National Australia Bank. "Taxi operator and consumer feedback from the trial will be used to refine the system in readiness for national roll out to all participating taxis, commencing early 1996," Mr Kermode said.

To more closely align and integrate taxis with the general public transport system, the new taxi terminal will provide a connection for Australia's first transport smart card, Transcard.

DSTO REDEVELOPING R&D FACILITY

The Department of Defence has awarded a $48 million construction and redevelopment contract to Australian construction group Baulderstone Hornibrook. The Minister for Defence Science and Personnel, Mr Gary Punch, said the company would construct a new two storey building of 29,500 square metres, which will be the centrepiece of the redevelopment of the Defence Science and Technology's (DSTO) research facility at Salisbury, 25 kilometres north of Adelaide.

Mr Punch said the building would be the largest single construction project in South Australia for several years. "The new building will accommodate nearly 600 staff. An additional 800 will be accommodated in existing and refurbished buildings," he said.

The complex will accommodate DSTO's Information Technology Division, Electronic Warfare Division, Land, Space and Optoelectronics Division, elements of Weapon Systems Division and Maritime Operations Division, as well as library, administrative and support services.

GLOBAL JV FOR TELEPHONY-OVER-CABLE

Scientific-Atlanta Inc and Siemens Public Communications Network Group have agreed to enter into a joint venture for development and world wide marketing of telephony-over-cable products.

This announcement marks the next step toward implementing IMMXpress, an interactive multimedia network architecture combining various network management, broadband communications, and computing technologies. An alliance to deliver IMMXpress was announced in November 1994 and includes Siemens, Scientific-Atlanta and Sun Microsystems, with Siemens acting as the overall system integrator.

To deliver telephony-over-cable products, Siemens will contribute an investment of capital, technical and human resources will Scientific-Atlanta will contribute engineering and technical resources, and the intellectual property of its CoAxiom products.

Introduced in 1993, CoAxiom is the core technology enabling telephony and data services to be sent over fibre/coaxial cable networks simultaneously. Compatible with today's public switched telephone entwork, CoAxiom also delivers energy control and monitoring services without affecting current in-home wiring or equipment.

Telephony-over-cable is becoming a strong growth opportunity in telecommunications. To provide video services, telephone companies need more bandwidth than the traditional 'twisted pair' allows. Coaxial cables used in cable television services have a high capacity for broadband communications, but cable companies lack the vast switching infrastructure of telephone carriers. The new product will make it easier for Scientific-Atlanta's traditional cable customers to send voice over their existing cable networks.

NEWS BRIEFS

- Ruggedised L-band satellite terminals are to be supplied to Australian Defence by ***Rockwell Systems*** and ***NEC Australia,*** as part of the Defence Mobile Communications Australia Network.
- ***Nilsen Industrial Electronics*** has been appointed exclusive Australian and New Zealand distributor for the CALMU range of three phase energy metering and software products from Polymeters Response Internal.
- ***TCG Mega Systems*** has announced a distributor agreement with Computer Communications Specialists of Norcross GA to distribute and support the company's Interactive Voice Response systems.

NATIONAL SEMI EXPAND R&D CENTRE

The addition of a technology research and development facility in California represents a two generation leap in the manufacturing and process development of National Semiconductor. The facility, constructed at a cost of more than US$100 million, will be home to a 20,000 square foot, Class 1, 8" (200 millimetre), BICMOS and CMOS wafer fabrication centre with 0.35 micron processing capability.

Mr Bruce Gray, National Semiconductor's director of process development/integration and operations at Fairchild Research Centre, said: "By building this centre, National can provide our customers with the best in current and future manufacturing technology and research. Using next generation 0.35 micron technology, keeps customers in the forefront of analog and mixed signal semiconductor capabilities for use in their products."

Semiconductor circuits manufactured at this facility will contain elements as small as three and one half tenths of a micron (0.35) in a Class 1 clean room. A Class 1 clean room, which is 10,000 times cleaner than a hospital surgical room, is required to maintain the integrity of the circuits.

National's technology and process development centre, named the Fairchild Research Centre after National's acquisition of Fairchild Semiconductor, has been responsible for many of National's 'moving and shaping' products, such as the Digital European Cordless Telephone chip-set which is currently being tested and marketed in China and sold

throughout Europe; automotive airbag and anti-lock brake chips currently sold to the automotive market; and National's high performance, phase-locked loop chips targeted at the wireless communications market.

STANILITE TO BUILD PNG CELLULAR SYSTEM

Australia's Stanilite Electronics has signed a contact with Papua New Guinea's Post and Telikom Corporation (PTC) for the supply of that country's first mobile cellular telephone system. The contract value is approximately A$4.5 million over a five year period. Under the terms of the contract, Stanilite's Cellswitch based service is to be officially launched on December 1. The network will initially consist of six radio basestation sites in Port Moresby and two in Lae, with a single digital switch controlling all eight radio sites.

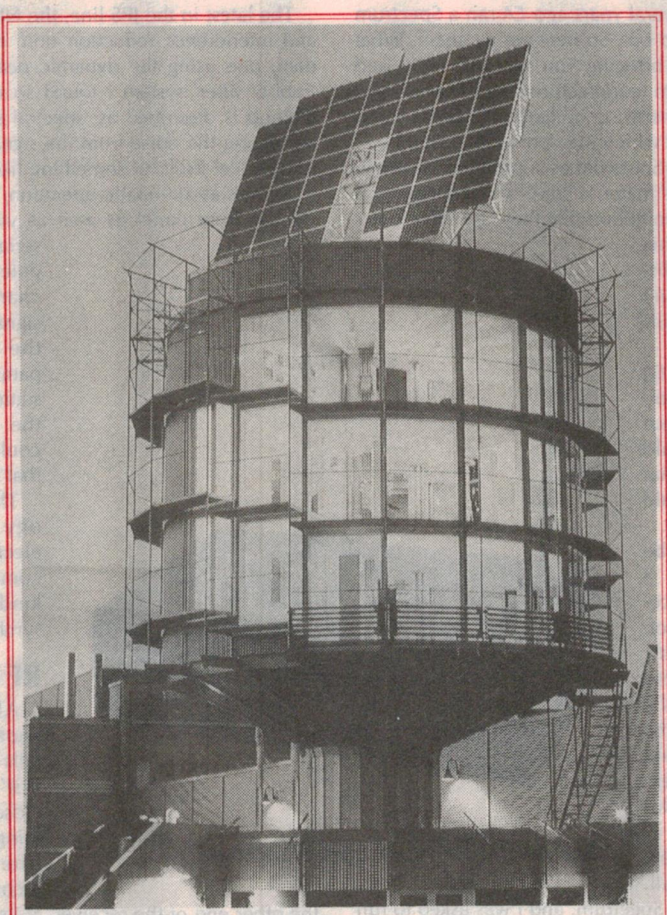
The PTC is optimistic about signing up at least 2000 subscribers in the first year of the network's operation, and hopes to expand coverage to other regional centres. PNG Communications Minister John Momis said that while the PTC board had initially considered digital GSM technology, it eventually decided on Stanilite's low cost, modular AMPS system for a variety of reasons. These included the relative costs of the two technologies, cost and availability of handsets and the roll out times required for each, as well as strategic considerations.

MICRO '95 FOR ADELAIDE

Leading experts in microelectronics from America, Europe, Asia and Australia will meet in Adelaide for Micro '95, the 13th Australian Microelectronics Conference, which will be officially opened on July 16 by South Australian Minister for Industry, Manufacturing, Small Business and Regional Development, Mr John Olsen.

Micro '95, which is sponsored and organised by The IREE Society in conjunction with The Institution of Engineers, Australia, is the leading national conference on microelectronic research, technology and applications.

The theme for this year's conference is 'Technology Today For The Future', focusing on those microelectronic technologies which have the potential to make a major contribution to national wealth in coming years. Specific topics to be discussed include microengineering, nanotechnology, multi-chip module technology and very high speed circuit technology.



Siemens built this 55 square metre solar array, mounted on the roof of the solar tower building at Oggenburg-Elgersweier in Germany. The largest roof top photovoltaic plant in Germany, the 'sail' follows the sun's position automatically and delivers about 90,000kW hours of electricity per year.

Among the speakers at Micro '95 will be Mr Takayuki Hirano from the Micromachines Centre in Tokyo; Dr Bryan Ackland of AT&T Bell Laboratories; Prof Paul Franzon of North Carolina State University; Prof Antonio Nunez of the Centre for Applied Microelectronics, University of Las Palmas; Prof Robert Clarke of the University of New South Wales; Prof Jong-Duk Lee of Seoul National University and Dr Myung-Hwan Oh of the Korean Institute of Science and Technology.

FEDERAL GOVT INFO ON INTERNET

Details of this year's Federal Budget were available on the Internet for the first time, according to the Federal Minister for Administrative Services, Mr Frank Walker. Budget details were accessible on the Internet after 7.30pm on Budget night, and included the Budget Speech and a general overview of the Budget.

"Those with access to the Internet, including businesses, accountants, lawyers, students and library users can benefit from this new service," Mr Walker said.

The Internet address for the service is http://gov.info.au.

"Public Internet access to government information is progressively becoming available at all Commonwealth Government bookshops," he said. "This is tangible evidence of the Government's commitment to improved access to government information."

GPS FOR MELBOURNE CABS

Raywood Communications has signed a $1.5 million contract with Silver Top Taxis in Melbourne, to supply a GPS based automatic vehicle location system for their fleet of 1400 taxis.

Although one of the more evident benefits of this system will be to locate vehicles in which the driver is under attack, its day to day use will be to ensure faster, more efficient deployment of the fleet and a faster customer response time.

Based on the US Department of Defense constellation of satellites known as the Global Positioning System (GPS), and Silver Top's existing mobile data radio network and intelligent mobile data terminals for dispatch and information transmission, it will become the largest single fleet using GPS for fully automatic dispatch in the world.

The addition of GPS to the already high level of automation will mean that the distances travelled by empty cabs will be reduced, thus improving profitability for both the owners and the drivers.

The system is planned to be fully commissioned by the end of October this year. ❖

SPECTRUM

Communications News & Comment

Conducted by
Tom Moffat

A column is reborn...

Welcome to Spectrum (reborn). Several years ago *EA* ran a Spectrum column, but for some reason it fizzled out. So here we go again. What we'll be doing, this time around, is bringing you news of radio and communications matters, sourced from manufacturers and importers of communications equipment, governments, chit-chat on amateur radio and the Internet, and other scuttlebutt which may prove interesting.

What we will *not* be doing is using Spectrum as a commercial showcase. You will not see any 'advertorial' material here. No advertiser will be invited to buy space in *EA* on the condition that they 'get some copy into Spectrum as well'. In fact this column is being produced 1000km distant from the *EA* offices, so I wouldn't have a clue who the advertisers are. Furthermore, I don't want to know...

Of course there's nothing to stop *EA* management ringing a potential advertiser and saying, "Moffat's done a piece on your product in Spectrum. Would you like to run an ad as well?" That would be quite legitimate, since I would have no involvement in it.

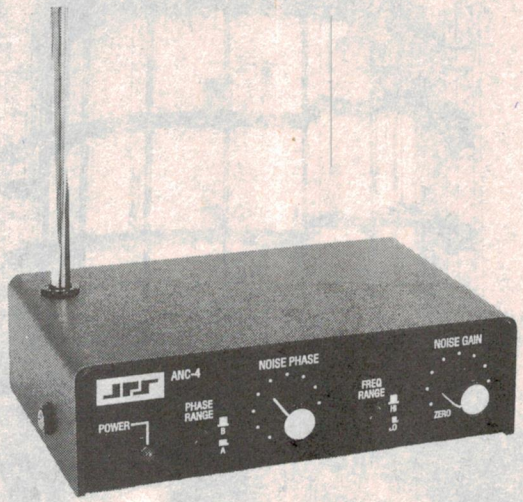
So what gets into Spectrum will be determined by its news value only — a novel product, an important pronouncement from an industry leader, a decision by the Spectrum Management Authority, or just a fat juicy rumour. I am also hoping to concentrate on things actually accessible to *EA* readers, so there will be a lot of stuff about shortwave radio and home computer technology, at the expense of reviews of half-million dollar satellite earth stations.

We were very lucky to get this new Spectrum column off the ground at all. Early this year *EA* decided to resurrect Spectrum, and I was asked to run it. We thought the best way to get started would be to tell communications companies of Spectrum's existence. So we picked out eight targets who are most active in the communications field, and I sent each of them identical faxes explaining what we were on about and asking them to submit news of their activities.

Several weeks went by without so much as a squeak from any of them, and I sent an e-mail to *EA*'s Editor Jim Rowe suggesting we give the whole Spectrum idea the heave-ho. That was at 8:00am, and by coincidence, only a couple of hours later I got a phone call from John Weir of ZRV Electronics, saying a belated thanks for the fax and they'd love to contribute to Spectrum. So what you read this month is limited to just the one company; nothing has been forthcoming from any of the others. Maybe once they see what Spectrum looks like they'll come through with the goodies. How about it, troops?

'Pro' noise eater

You may remember over the past few months we've reviewed some of ZRV's noise reduction units, from JPS Communications in the USA. These range from quite complicated to very simple, but they all provide useful enhancement of incoming signals by performing surgery on the audio that comes out of the speaker socket — in other words, no mods are required to the radio to use these gadgets.



The ANC-4 RF noise cancelling device.

The latest in the JPS line, the NIR-12, is billed as a *professional* noise and interference reduction unit. It has two DSP units working in tandem, one using the dynamic peaking method which I suspect is the 'rubber filter' system I found so useful in the earlier units. The other method is described as 'spectral subtraction', which suggests they are separating the noise from the signal, turning it upside down, and using it to cancel itself (or something like that)...

As well as automatic operation, the NIR-12 offers full manual control via the front panel as well as via RS-232 signals from a computer's serial port. Presumably this means a computer can be used to tailor various filter characteristics to a particular incoming signal. It seems it would be possible, with the right software, to then save the parameters found best for each individual station you listen to, so when you tuned the station again sometime later, you could instantly customise the NIR unit for that station.

This RS-232 access to modern technology opens a whole new sport, for electronikers who also like the odd bit of computer hacking. I've been having all kinds of fun 'improving' a Korg music synthesizer through its RS-232 port.

RF noise cancelling

Also from ZRV Electronics comes another noise reduction device, which falls into the 'why didn't I think of it first' department. This one is aimed at close-in radio noise, generated by such things as passing cars and sizzling power lines. Instead of working on the recovered audio, the new ANC-4 attacks the other end of the receiver, at its antenna.

The idea is that you have a normal antenna mounted outdoors, which is receiving both the desired signal and noise from nearby sources. Inside, close to the receiver, is the ANC-4, a small black instrument with a whip antenna poking out the top.

The noise reducer scheme assumes the desired signal will be insignificant at the indoor whip antenna, leaving only the nearby noise. So it inverts the noise signal from the whip antenna by 180° and then adds it to the signal coming from the outside antenna. The noise thus cancels, but since the desired signal is only coming from the outside antenna, it is unaffected.

The ANC-4 has adjustments for gain of the noise from the inside antenna, and you can also vary the phase away from the nominal 180°. It is also possible to use the device on its own as an 'active antenna' if an outside antenna is not available. Of course there would be no noise cancellation in this case.

The device can be used with a transceiver up to 150 watts as well as a receiver. When the radio transmits the ANC-4 detects the RF and causes its own receiver to be bypassed.

The ANC-4's noise reduction technique is interesting, although only testing will tell how effective it is. My own solution to near-in noise problems is to use a balanced antenna with a balanced parallel feedline; that way the feedline itself cancels noise since both wires receive

nearby noise in the same phase, while external signals from the antenna are out of phase and can thus pass through a balun transformer into the receiver. But even the balanced antenna system suffers badly, when assaulted with something like the elderly Kenwood Chef food mixer that lives in our kitchen.

This monster with its brush-driven motor is a true menace to radio communication, as is the microwave that sits next to it. I'm hoping to try out one of these ANC-4 units to see how it shapes up under the 'kitchen test'.

Unusual SW station

I mentioned shortwave earlier; it might be interesting to talk about individual shortwave stations that might be unusual, or even controversial. The hottest topic at the moment seems to be WWCR, a radio station broadcasting as World Wide Christian Radio from the 'Bible Belt' of southeastern USA. With a frequency of 5065kHz, WWCR is obviously me ant for domestic consumption in North America; but it can be heard in Australia at good strength in late afternoon and early evening.

It appears that WWCR sells time in one-hour blocks, to anyone and everyone who wants to say something, but can't get a go on the mainstream media. Because of the right to free speech in the USA, broadcasters on WWCR can say anything they want — nobody can stop them. Implicit in the right to free speech is the right to NOT broadcast someone's ideas; nobody can force you to. It appears that WWCR's purpose in life, then, is to give a voice to those who would otherwise be denied one...

Most of WWCR's programs seem to come from rather extreme groups of religious fundamentalists. One program I heard here in Australia had anti-abortion as its theme, and it began with a bluegrass-style song about 'I don't want my unborn baby to die'. This musical number was accompanied by the sound of babies screaming in agony.

I first stumbled on WWCR while I was visiting America early this year. I had my little Sony shortwave portable with me, and every now and then I'd put it on 'scan' and let it go. One night it stopped on a talkback radio program called 'Radio Free America'. Most of the callers seemed to be zealots of one kind or another, but primarily right-wing militants who felt that the United States government was about to surrender its citizens into a 'world' government.

Because WWCR is allowing the voicing of these views, much debate on the Internet is accusing the station of instigating the bombing of the Federal Building in Oklahoma City earlier this year. In fact people are saying the Radio Free America's compere Tom Valentine will soon be arrested and charged as an accessory to the bombing.

As this is being written there are some very harsh words about WWCR radio, flying back and forth from both sides. But the fact that this debate is allowed to take place at all is a testimony to the right of free speech on the Internet — long may it prosper!

With the present timetable it's unlikely you'll get to hear Radio Free America for yourself. It's on for three hours every day from 0200 UTC which works out as 12:00 noon in Australia; not a really good time for propagation from the USA on 5MHz. Which is a pity, because the debate over the Oklahoma City bombing would make interesting listening.

WWCR is being called two things — 'Dissident Radio' by its supporters, and 'Crackpot Radio' by its detractors. Still, if you believe that everyone should have a right to speak their minds, WWCR certainly has a role to fill. It's the closest thing the USA will ever have to an 'underground' radio station.

The reason we chose to pick on WWCR this month is not because it is a rare DX catch, but because of its rather free-spirited programming policy. It also helps that it broadcasts in English, although if you listen to some of the deep southern good ol' boys who phone Radio Free America, the accents are a little hard to cut through. Should you come across any other unusual broadcasters, I'd certainly like to hear about them. Also unusual RTTY or fax services.

And as for other news for Spectrum, if you'd like to have your item considered for inclusion (no guarantees, of course), you can send it direct to me at 39 Pillinger Drive, Fern Tree, Tasmania 7054. Please, no phone calls though, I just don't have time to take down stuff over the phone. ❖

NEW PRODUCTS

AM/FM receiver covers 1kHz -1GHz

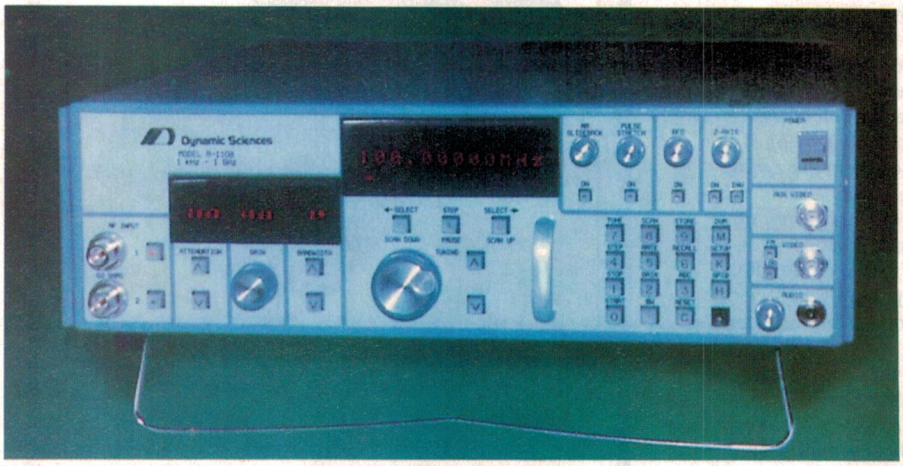
The DSIR-110B wide range AM/FM receiver from Dynamic Sciences is an enhanced version of the R-110 series of receivers, with features to facilitate both automated and manual operation. The receiver covers the frequency range of 1kHz to 1GHz, with a noise figure of better than 10dB.

It includes AM/FM demodulation, 33 bandwidths from 200Hz to 200MHz in a modified 1:2:5 sequence, pulse stretch and slideback controls. Also fitted is an accurate peak reading wideband DVM to measure and display video signal level, and provide encoded data via the IEEE-488 bus. Visual and audible indicators warn of incorrect operation and out of spec conditions.

The front panel has been engineered for clarity and ease of operation. A full complement of analog controls, pushbutton switches, keypad and highly legible alpha-numeric displays are provided.

The receiver can be enhanced with plug-in modules and optional accessories to configure it for particular applications. The frequency range can be extended down to 100Hz. With the optional R-1180 microwave downconverter the range can be extended up to 18GHz. The receiver is supplied in a portable configuration which includes collapsible handles and a folding stand. Rack mounting fittings are also available.

For further information circle 242 on the reader service coupon or contact Dynamic Sciences Australia, 614 Hawthorn Road, East Brighton 3187; phone (03) 596 0155.



Portable 100MHz Scopemeter

Philips has introduced Fluke's new 100MHz Scopemeter Series II, model 105. This new handheld instrument is a high bandwidth digital storage oscilloscope and a true RMS digital multimeter.

Offering 100MHz bandwidth, the instrument is claimed to be easy to operate, with menu driven operation and one button access to over 30 common measurements.

The instrument allows the user to switch quickly between meter and scope functions and in either mode provides both numeric readings and a waveform display of the measured signal.

Users simply select the desired meas-

Flush mounted quad powerpoint

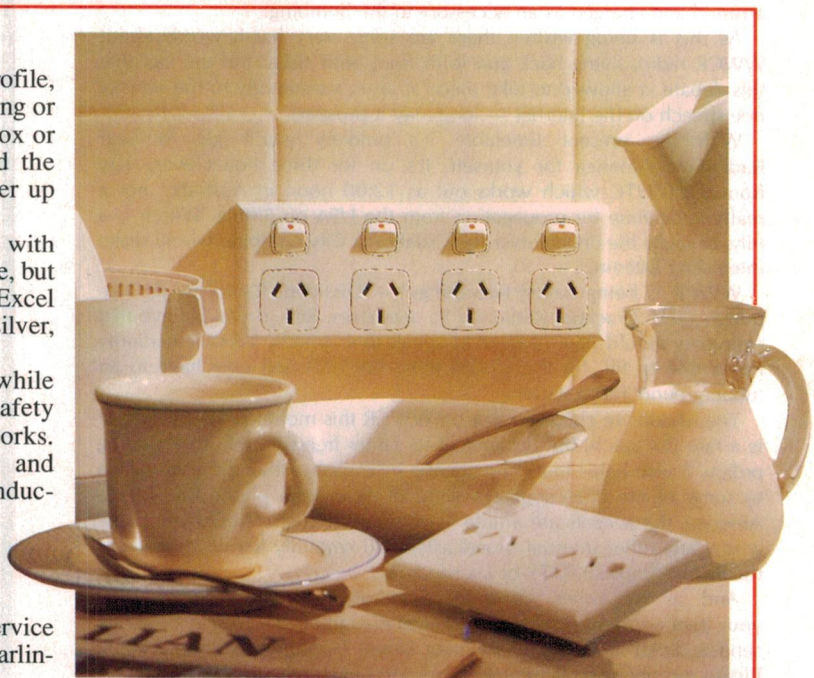
HPM Industries has released the XL777/4, a low profile, four in one powerpoint that will replace or fit any existing or new, single or double powerpoint, and standard wall box or bracket. The powerpoint replaces powerboards and the jumbled mess of cords and double adaptors that clutter up any area where more than two appliances are used.

Being part of the Excel range, the XL777/4 comes with snap-on cover plates. The first production run is in white, but it will soon be available in matt or gloss plastic in the Excel range of colours and metal finishes such as polished silver, polished brass, matt silver and gunmetal.

The unit is available in standard Excel format while the XL777/4 is for installations that require extra safety and isolation, such as laboratories and chemical works. It has a double pole option with neon indicators and safety shutters to prevent the insertion of foreign conductive material.

Both models are flush and fit all standard wall boxes and brackets (84mm standard mounting dimensions, which is universal throughout Australia).

For further information circle 241 on the reader service coupon or contact HPM Industries, 4 Hill Street, Darlinghurst 2010; phone (02) 361 9999.



urement, and the instrument automatically configures itself. The continuous autoset function eliminates the front panel reconfiguring normally required as the user moves from one test point to the next. As the output signal changes, the unit continually selects the proper time base, input range, trigger level, and trigger slope. At any time, these settings can be made manually for closer signal analysis. A new display technique is claimed to render waveform displays with the visual precision of an analog scope.

As well, a true RMS digital multimeter complements the instrument's scope functions. The integral DMM can measure up to four parameters simultaneously while displaying the signal waveform. True RMS AC or AC+DC accurately measures the voltage of square waves, pulse trains, noise and other non-sinusoidal waveforms up to 5MHz. As with the scope function, the meter's autoranging capability selects the best range for high accuracy and resolution.

Additional features include diode testing, continuity testing with beeper, glitch capture, waveform processing, waveform mathematics, signal generator output, component tester output, optically isolated RS-232 serial interface, backlit display, remote operation and on line help.

For further information circle 244 on the reader service coupon or contact Philips Scientific & Industrial, 34 Waterloo Road, North Ryde 2113; phone (02) 888 8222.

Technical model kit

Procon Technology now stocks the full line of Fischertechnik Profi construction kits. Of interest to the electronic enthusiast, is the Profi Sensoric kit. This kit provides 430 parts with a detailed 93-page manual describing the construction of 10 automated models including a carpark barrier, a cash dispenser, a sorting machine and an egg cooling machine.

The kit is useful for educational and training purposes in the field of automation technology, mechanical and electrical engineering. In addition it can be used for simulation and prototyping purposes.

The electronic flipflop unit provided with the kit allows each model to be automated. By connecting two different sensors (magnetic reed switch, photo-transistor, temperature sensor or micro-switch) the unit can toggle two outputs (motor, lamp or buzzer) on or off. The flipflop unit includes two sensitivity controls and four indicating LEDs. Included in the kit are one flipflop unit, one motor and gearbox, one reed switch and actuator, two micro-switches, one thermistor, three lamps, one buzzer, one 9V battery holder and other assembly components. Other kits in the Profi range are; I'm Walking, Cartech and the computer controlled Profi Computing package. Prices start at $149 for the I'm Walking and Cartech kits. The Sensoric kit costs $299 (prices include sales tax).

For further information circle 243 on the reader service coupon or contact Procon Techology, PO Box 655, Mount Waverley 3149: phone (03) 807 5660.

Digital clock system

Hertz Electronics has introduced a range of multi-functional digital clocks, available as stand alone units or as part of a synchronised master clock system. The clocks are fully programmable and can be changed if a different setting is required in the future.

The range includes different case and display styles, such as time-of-day, calendars, start-stop watches and up to 15 time zones. The clocks are based on the Swiss system and synchronise to 482 time codes, which means only the master needs to be set when times are changed. Installation is fast, because as soon as the master time is set all connected clocks automatically display time, date and/or zone time. Each clock has a microprocessor and a high quality quartz crystal.

The digital clocks are available with red or green LEDs in a range of square and rectangular cases, from quite small units to large displays that can be read from a considerable distance.

For further information circle 247 on the reader service coupon or contact Hertz Electronics, PO Box 173, Edgecliff 2027; phone (02) 363 3029.

D subminiature backshells

A new series of D subminiature backshells designed and made by Amtron Australia is now available for use in the electronics and telecommunications industry. Currently they can be supplied in nine way, 15 way or 25 way versions only, 37 way and 50 way versions will be available later this year. All backshells are offered with or without RF shielding.

A novel feature of the backshells is the number of cable entry points available in each type. The nine way has two entries, while the 15 way and 25 way versions have three entries, which are 60°, straight and 90°. The 37 way and 50 way will also be available with three entries, similar to the 15 way and 25 way backshells.

The new backshells were developed by Amtron after winning a five year contact from Telecom to supply bit packs of complete D subminiature connectors using the RF shielded version. The RF shielded backshell has been tested by RF Industries to Mil Std 285. Each backshell comes with a set of different diameter grommets, with cable size determining the one to be used.

For further information circle 248 on the reader service coupon or contact Amtron Australia, 687 Gardeners Road, Mascot 2020; phone (02) 317 5511.

IR Remote Control Tester

Being able to actually 'see' an IR light source makes servicing and adjustment of IR based equipment so much easier. In this review, we look at a simple, inexpensive kit from Oatley Electronics for just such a device.

by PETER PHILLIPS

These days virtually all domestic electronic equipment uses infrared (IR) light. Most remote control systems are infrared, and all CD players and laser disc players have an IR light source as the 'pickup'. Other IR light applications include IR lasers for security 'fencing' or for communication.

IR light has the advantage of being invisible to humans, which is why it's useful for security purposes or for data transmission, as in a remote control system. But its invisible nature does pose a problem when it comes to repairing IR equipment.

Test strips coated with an IR responsive phosphor are available, but these are often not sensitive enough. Another way to 'see' an IR light source is with an IR sensitive receiver, such as that described in *EA* September 1990. With this device, the strength of an IR source is displayed by a meter.

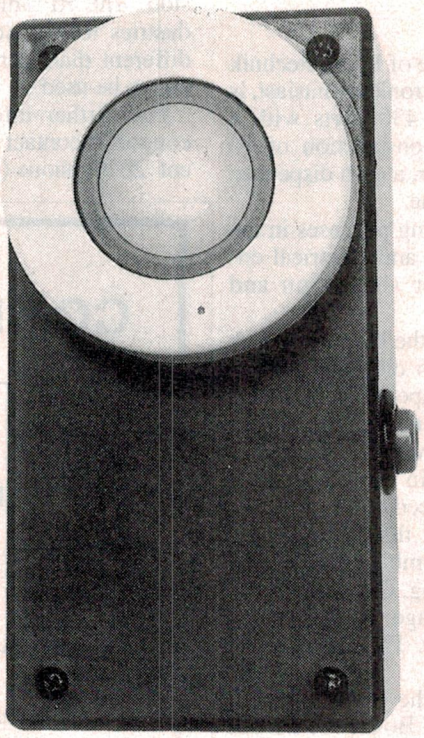
But the best way is with a device that actually lets you see the light source. For example, it's easy to check a conventional LED by confirming that it lights when power is applied. Imagine being able to do the same with an IR LED or laser beam!

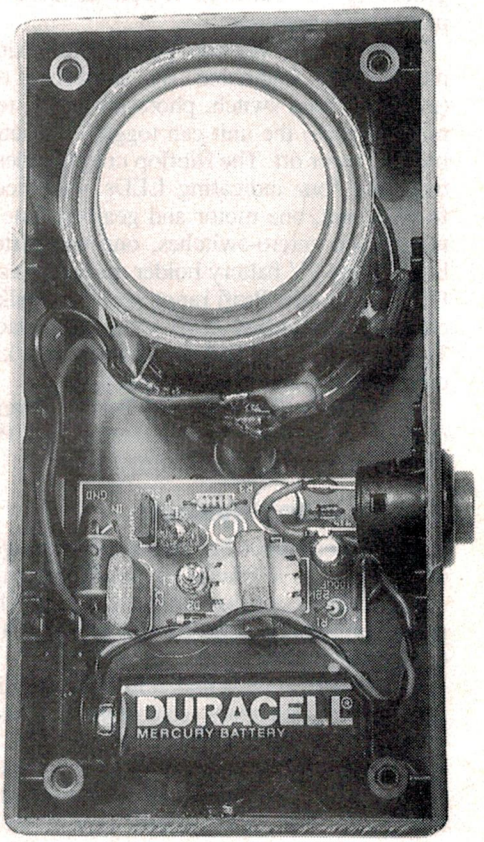
IR viewer

Regular readers will be aware of the various IR night viewer projects we have published over the years. All of these have come from Oatley Electronics, who have built up a name as specialists in this field. A problem with IR night viewer tubes is their expense, although prices have been falling over recent years as more of these devices come onto the disposal market.

In fact, since becoming involved in the field, Oatley Electronics has built up quite a stock of night viewer tubes. Some of these, because of previous improper use (remember these are disposal items) have a blemish of some sort. This means a part of the viewer screen doesn't respond, giving a black mark on an otherwise green screen.

To date, these tubes have been sorted out and put to one side, as they are not really suitable for a night viewer unless the blemish is very small. In fact, those with a small blemish are sold as such, but at a lower price than an unblemished





Above: This simple tester lets you see if an IR source is emitting IR light. Just press the button and look at the source through the tester. A kit of parts costs $30. Left: This shot shows the type of tube that comes with the kit. The tube requires a high voltage to operate, derived from a battery powered inverter. Right: Here's how everything is assembled inside the plastic case. Clearly visible are the inverter PCB and tube. The voltage multiplier components are held to the side of the tube with a spot of glue.

tube. So as you can guess by now, the kit of parts for this IR tester includes a blemished tube, which is why the price is so low.

The IR tester

The kit for this simple tester includes a blemished IR night viewer tube like that shown in Fig.1. Each tube is tested before being sold, and those with a blemish of more than 20% of the screen are discarded.

Tubes that are blemished by 10% or less are sold at prices ranging from $50 and up. But those between these categories are ideal for an IR tester. So the tubes used in this tester have a blemish of no more than 20% of the screen, and often less.

A night viewer tube needs a high voltage to operate, and this is achieved here with a small battery-powered inverter. The kit contains all the components to build the inverter, and even includes a silk-screen printed board and the pushbutton.

Evaluation

We were supplied with a ready-built unit, but as you can see in Fig.2, construction and assembly are very simple. Everything fits neatly into a 65 x 130 x 40mm plastic box, and is held in place with dabs of silicone glue. The voltage multiplier should be potted in neutral cure silicone glue, to prevent ionisation and the occasional spark discharge around the high voltage parts.

Although not essential to its operation, as the lead photo shows, the appearance of the device can be improved by fixing a plastic endcap over the projecting part of the tube. The cap used in the prototype is a 56mm plumbing fitting bought from a local hardware shop.

Cut the cap to leave a cover height of 15mm, then drill a 35mm hole in the top.

To test the unit, we looked at the output of a range of IR remote control transmitters. We found it quite easy not only to confirm if a transmitter was working, but to see if *all* the IR LEDs were working. This is important, as a transmitter working with less than its full complement of IR LEDs might not appear faulty, just 'weak'.

One difficulty, which is easily overcome, is overload of the night viewer tube. Remember that these tubes are very sensitive to visible light as well as IR light, and normal daylight will overload the tube. With the prototype, too much light caused the screen to blank out, making it appear the unit was no longer working.

The simplest solution is to use the tester away from strong light. A more elegant method is to fit a pin-hole lens over the input end of the tube.

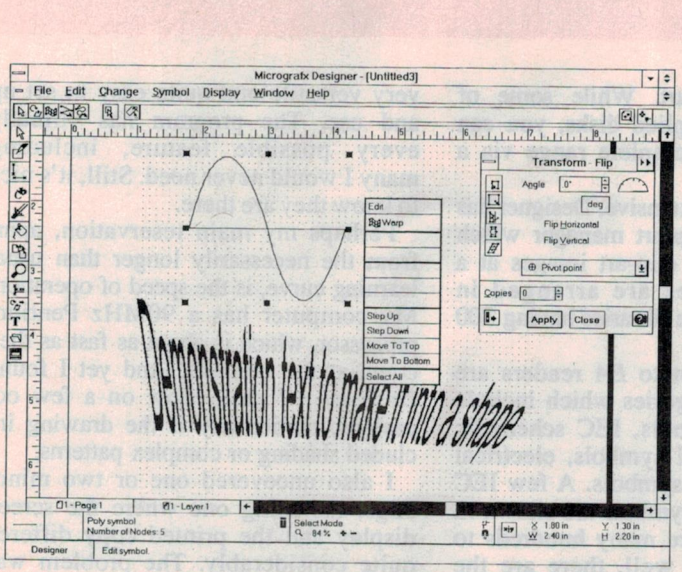
This can be done with another 56mm plastic endcap, this time with a 2mm hole drilled in the top of the cap. While the cap could be glued to the case so it's permanently fixed in place, the tester is probably more versatile if the cap is fitted as needed, but removed otherwise.

Incidentally, when the pin-hole lens is in place, the tester becomes a reasonably well focused night viewer. You could add a conventional camera lens to get even better results.

This device makes servicing and adjustment of IR-based equipment so much easier, and we used it extensively in the development of an IR based project. In fact, this is one of those devices that you really can't do without once you've used it for a while.

The retail price of the kit (includes blemished IR tube, all components for the EHT inverter and construction details) is $30.

For more information contact Oatley Electronics, PO Box 89, Oatley West NSW 2223; phone (02) 579 4985. ❖



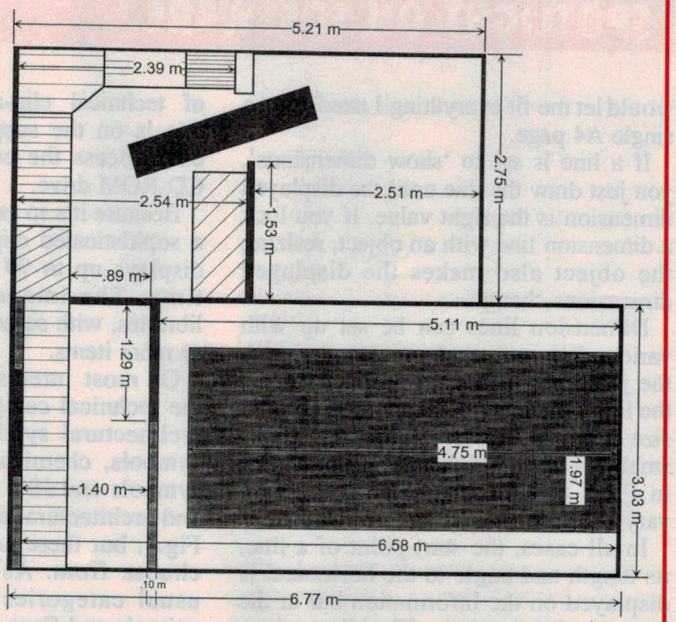


Fig.1 (above): This screen shot shows the screen display of Designer 4.1. The dialog box near the sinewave is invoked with the right mouse button. The transform box can be on or off as needed. Fig.2 (right): This diagram shows the dimensioning feature of Designer 4.1. The black object is a piano, and the diagram was drawn to test if the piano could be moved from its present position to the garage.

vantage of not resizing the drawing, so it's usually quite easy to enhance a drawing via Designer. Of course the whole drawing could be done in Designer (or Corel), except you've now lost the facility of an integrated wordprocessor and drawing package as with AmiPro.

The drawing section of *Designer 4.1* has an almost bewildering array of features, many of which were present in the old version. However the key strokes or mouse 'points' are very different, and I found it took quite a while to get used to the new interface.

The screen shot in Fig.1 shows the interface, where the 'toolbox' is on the left of the screen. You can add icons to the toolbox, up to two rows in fact. Selecting an icon from the toolbox brings up a 'ribbon' which displays an additional range of icons. So to draw a rectangle, you select the draw icon from the toolbox, then the rectangle icon from the ribbon.

Pressing the right mouse button brings up a dialog box with a range of options to manipulate the selected object. Other dialog boxes, like the 'transform' box can be left on-screen all the time.

Text 'warping' now matches that of *CorelDraw*, and text can be made to follow an object. When text is entered into a 'text box', the text handling facilities are almost equal to that of a decent wordprocessor. The box can be moved and sized as needed, like a desktop publishing program.

There are a large range of options to facilitate drawing an object. Icons let you select all kinds of curves, semicircles, ellipses and so on, making waveforms quite easy to draw. Objects can be created by combining a number of shaped lines, rather than tracing the object from start to finish. Once created, an object can be filled from a large array of possible patterns, colours, shades and so on.

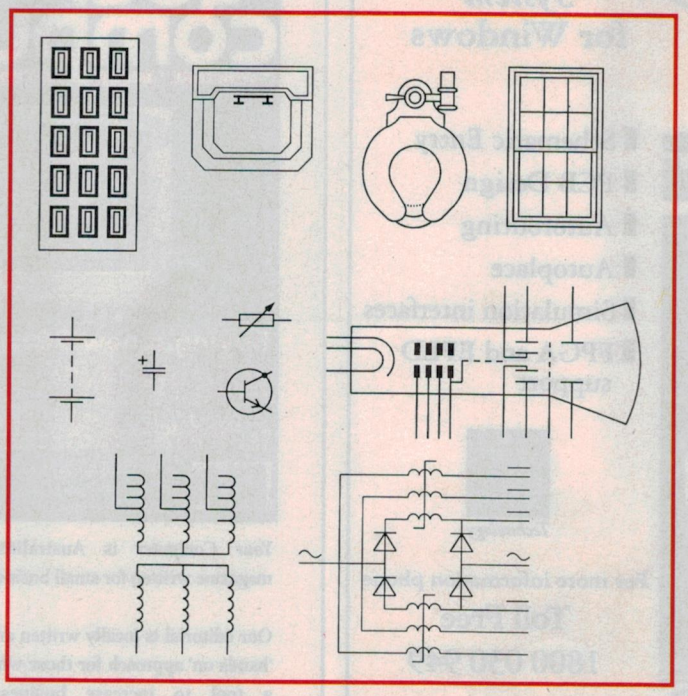


Fig.3: There are hundreds of architectural and IEC schematic symbols available as clip-art. This diagram shows a few of these.

Of course all these features make navigating your way around the program rather more difficult. However, once you've mastered it, the program is easy to use and has an amazing flexibility. But what of the technical aspects?

Dimensioning

My first real test of the dimensioning feature of *Designer 4.1* is shown in Fig.2. I wanted to modify my workshop and office with additional walls and doors. However, I had to make sure I could still get my piano out of the house as before, which is via the workshop into the garage.

So the drawing had to not only be accurate, but suitable for use by the carpenter who would do the additions. *Designer 4.1* lets you set up a dimension to scale, so I chose one that

would let me fit everything I needed on a single A4 page.

If a line is set to 'show dimensions', you just draw the line until the displayed dimension is the right value. If you lock a dimension line with an object, resizing the object also makes the displayed dimensions change.

Dimension lines can be set up with various line ends and weights. As well, the position of the dimension value on the line can be varied. Changing the font size of the dimensioning text allows very small dimensions to be displayed. Notice in Fig.2 that the displayed dimensions vary from 0.1m to 6.77m.

In all cases, the start point of a line, its length and angle to the horizontal is displayed on the information bar at the bottom of the screen. The dimensions of a rectangle, ellipse, circle etc are also displayed.

However, these are not scaled, so a scaled dimension line of say 46mm (as displayed at the bottom of the screen) might show a dimension value of 9.2m, depending on your scale setting.

A feature of *Designer 4.1* is its range of technical clip-art. While some of this is on the supplied disks, you can only access the complete range via a CD-ROM drive.

Because it's so extensive, Designer has a sophisticated clip-art manager which displays up to 99 clip-art images at a time. The images are arranged in libraries, with some libraries having 300 or more items.

Of most interest to *EA* readers are the technical categories which include architectural symbols, IEC schematic symbols, chemical symbols, electrical symbols and ISO symbols. A few IEC and architectural symbols are shown in Fig.3, but there are many hundreds to choose from. As well, there are the usual categories of people, places, animals and flags.

Summary

My overall impression of *Designer 4.1* is mixed. The technical enhancements are likely to be very useful for many people, although some of the clip-art symbols are not relevant to Australia. The dimensioning facility is very versatile and quite easy to set up and use. The program has virtually every possible feature, including many I would never need. Still, it's nice to know they are there.

Perhaps my main reservation, apart from the necessarily longer than usual learning curve, is the speed of operation. My computer has a 90MHz Pentium processor, which is about as fast as they come at the moment. And yet I found *Designer 4.1* quite slow on a few occasions, particularly if the drawing included shading or complex patterns.

I also uncovered one or two minor bugs, including one where the screen display and the printed copy differed quite considerably. The problem was solved by not using a particular fill pattern. But in a program so complex, it's reasonable to expect a few problems.

The program has a recommended retail price of $245. Registered users of version 4.0 can upgrade for $95, and registered users of 3.1 can upgrade for $195. The review copy was supplied by Micrografx Australia; phone (02) 415 2642. ❖

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Data Acquisition & Control:

PC-BASED 'SCOPE, METER, DATA LOGGER

Here we look at a small, inexpensive unit that when plugged into the parallel port of an IBM compatible computer, can perform the role of a dual-trace 'scope, a digital meter, a spectrum analyser, a frequency counter or a data logger.

by PETER PHILLIPS

When I was researching the efficacy of recharging dry cells recently, I needed a data logger to record the discharge voltage of up to four cells at a time.

Emona Instruments came to the rescue with a small unit called the Pico ADC-16, and I was so impressed with it that I suggested we review it.

However, before I started writing the review, Emona showed me the ADC-100. It took me a very short time to realise that here was a device that would interest far more readers, as it combined all the data logging features of the ADC-16 with... well, you read the list of virtual instruments in the introduction.

In fact, the ADC-100 is best described in two parts: as a data logger, and as a computer-based range of measuring instruments. We'll start with the data logging function, but first a quick overview of the unit.

ADC-100 overview

The ADC-100 is part of a family of similar data acquisition products from the UK company Pico Technology. Essentially, each device in the family is nothing more than an analog to digital converter (ADC), housed in a small plastic case (145 x 85 x 25mm). A DB-25 connector allows the ADC to be connected to a computer, and input terminals connect the analog inputs to the ADC. The units don't need any external power, and are completely software driven.

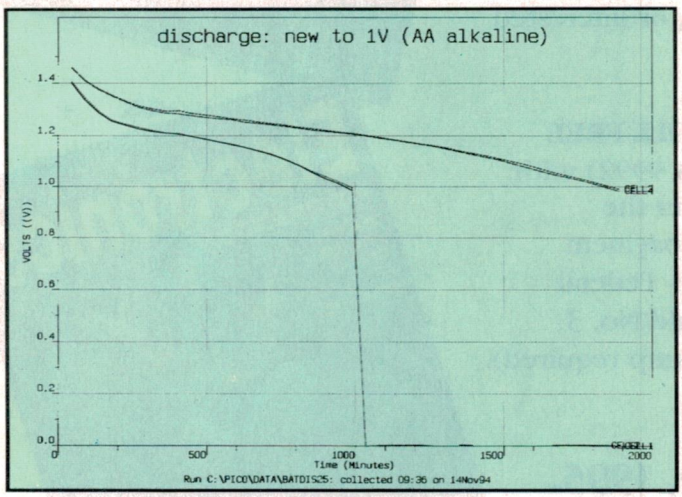
Like most devices in the family, the ADC-100 runs with the Picoscope software, which allows it to emulate an oscilloscope, a voltmeter, a spectrum analyser and a frequency counter. However the ADC-100 has by far the highest sampling rate (100kHz), which gives it a theoretical Nyquist bandwidth of 50kHz, more than enough for audio purposes.

Included with the unit is a 3.5" disk containing the necessary software, and three small manuals. These cover a description of the unit, the data logging software and the Picoscope software.

Data logger

Unlike the ADC-16, which has eight inputs, the ADC-100 has two. The software selectable input voltage ranges are (+/- for all) 20V, 10V, 5V, 2V, 1V, 500mV and 200mV, either AC or DC. The sampling rate depends on the computer, and is up to 120k samples per second for a '486/66 DX2. The resolution is 12 bits, the input impedance is 1M and both inputs are via BNC connectors.

The unit connects via a conventional



TAB-NOV11-1

Date	Time	Time Minutes	Sample No	VOLTS	VOLTS	VOLTS	VOLTS
14Nov94	09:37	15	1	-0.003	0.000	-0.002	0.003
14Nov94	09:38	30	2	1.435	1.441	1.485	1.483
14Nov94	09:39	45	3	1.401	1.406	1.459	1.457
14Nov94	09:40	60	4	1.374	1.381	1.438	1.437
14Nov94	09:41	75	5	1.354	1.362	1.423	1.421
14Nov94	09:42	90	6	1.336	1.343	1.410	1.409
14Nov94	09:43	105	7	1.318	1.325	1.399	1.397
14Nov94	09:44	120	8	1.303	1.308	1.388	1.386
14Nov94	09:45	135	9	1.290	1.294	1.379	1.376
14Nov94	09:46	150	10	1.274	1.282	1.369	1.367
14Nov94	09:47	165	11	1.263	1.271	1.362	1.360
14Nov94	09:48	180	12	1.255	1.259	1.354	1.351
14Nov94	09:49	195	13	1.249	1.252	1.346	1.344
14Nov94	09:50	210	14	1.244	1.246	1.339	1.337
14Nov94	09:51	225	15	1.240	1.244	1.332	1.329
14Nov94	09:52	240	16	1.233	1.240	1.324	1.322
14Nov94	09:53	255	17	1.230	1.235	1.318	1.315
14Nov94	09:54	270	18	1.225	1.232	1.313	1.308
14Nov94	09:55	285	19	1.222	1.229	1.310	1.304
14Nov94	09:56	300	20	1.219	1.225	1.307	1.299

Fig.1 (left): This is a printout directly from the Picolog software, showing four cells being discharged simultaneously. This was obtained from an ADC-16, which has eight inputs. The ADC-100 has two inputs, but is otherwise the same. Fig.2 (right): Tables can be set to have a number of variables, like those shown here. This table is from an ADC-16; the ADC-100 can only measure two inputs, not the four shown here.

25-way printer lead to a parallel port of an IBM compatible, and is driven by software that is normally installed on the hard drive of the computer.

The data logging software is not especially user friendly, but it has considerable flexibility. Once you get used to it, it's reasonably easy to set the software to sample at any interval, and scale the digital value read from the ADC to give a readout in suitable units (voltage, temperature, pressure).

Once the parameters are set, and the sampling process started, there are several options concerning viewing the sampled readings. The simplest is called monitor, which shows the most recently sampled value (in the units you've selected). A useful facility in this mode is the ability to set an alarm value. When I conducted the battery discharge tests, I set the alarm to go off when the battery voltage reached a certain value, so I could go about my business without having to continually check the readings.

The other report functions are 'table' and 'graph'. Both of these update with each sample, so you can see the trend of the readings. Then when the sampling run is complete, these can be printed as a record. A graph produced by the ADC-16 data logger, showing four cells being discharged is shown in Fig.1. On the screen, each of the four curves is a different colour, making it easier to determine what each one represents. The ADC-100 gives the same type of graph, except it has two inputs.

A table can be set up to have columns for a wide range of variables. The printout of a table is shown in Fig.2, where columns have been set up for the date, time, elapsed time in minutes, sample number and the voltage reading of each of the four cells being sampled. This table was also produced by an ADC-16, but is the same for the ADC-100 except for the number of inputs.

You can also use the data logger as an on-line voltmeter, by selecting Display Voltages from the main menu of the program. The voltage reading at each input is displayed on the computer screen, and continually updated. This is particularly useful to make sure the system is working before starting a sampling run.

The manual for the data logging software gives two examples that, if you follow them exactly, show the steps involved. However, I found the manual too brief, with an overuse of bolding to emphasise important words in the text. Nearly half the text is in bold! But once you understand the philosophy, the program is quite easy to use, and very versatile.

Virtual instruments

The Picoscope software allows the ADC-100 to emulate a dual-trace oscilloscope, an X-Y 'scope, an audio spectrum analyser and a digital meter that can also measure frequency. In fact, if you are only working with audio frequencies, this unit gives you almost every item of test equipment you'll ever need.

Unlike the rather arcane data logging software, the Picoscope software is much more intuitive, and extremely easy to use. This feature is most important, as all the facilities in the world are of little use if you can't access them.

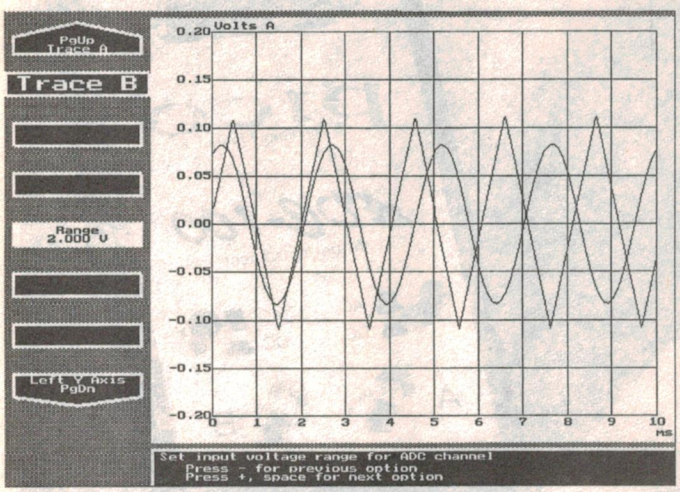
The page up and page down keys are used quite a lot to change functions within an instrument, or to change to another instrument. Each screen display tells you what keys are active, and what they do, and I found I rarely needed to refer to the manual.

Oscilloscope

The oscilloscope function is perhaps the most useful, and a typical display is shown in Fig.3. Like any 'scope, there are a range of controls to be set, such as the volts/div and the time/div. These are all set with the '+' and '-' keys on the computer keyboard. Unfortunately, laptop computers usually don't include a numerical keypad, so the '+' key has to be accessed with the shift key.

While being able to see a waveform is useful, often of more use is a storage facility. This, plus the ability to get a printout of the display makes the oscilloscope more versatile than most conventional 'scopes. Naturally you can measure frequency and voltage from the

PC Based Scope, Meter, Data Logger



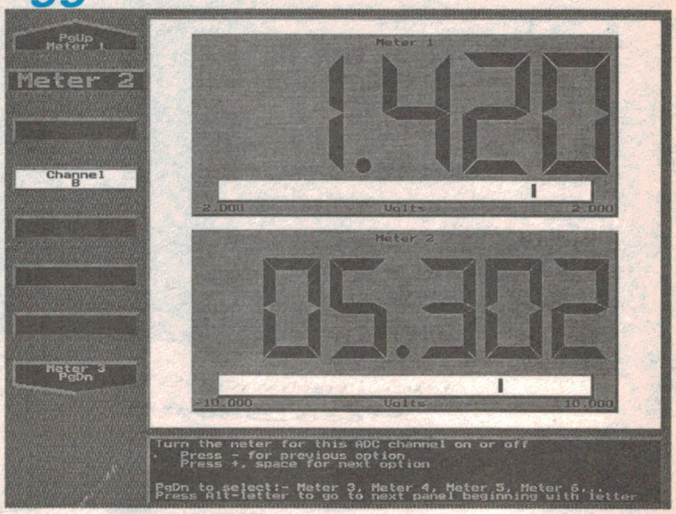


Fig.3 (left): This is how the Picoscope software and the ADC-100 show two 400Hz waveforms, one a sinewave, the other a triangular wave. Fig.4 (right): The ADC-100 can operate two on-screen digital meters together. Here each meter is measuring a different DC voltage.

display, as well as move the trace up or down the screen. In fact, the only limitation of this 'scope compared to a conventional unit is the bandwidth. But for audio purposes, it is more than satisfactory.

X-Y 'scope

The X-Y function of an oscilloscope lets you display Lissajous patterns, often to measure frequency. This facility is selected from the main menu of the program, and the oscilloscope is operated as before, except now both inputs are controlling the display.

Another use of an X-Y display is to show one variable against another, such as stress against strain. Obviously these parameters have to be converted to a voltage with suitable transducers. Again the display can be saved and printed out as needed.

Spectrum analyser

While you might already have an oscilloscope and one or more multimeters, it's likely few people will have an audio spectrum analyser. It's this feature alone that made me decide to buy the review unit, for myself.

To illustrate a use, consider measuring distortion, perhaps from the output of a signal generator. If the output is a pure sinewave, you'll see a single energy peak on the display at the fundamental frequency of the signal. If there's distortion and noise in the signal, it will show as energy bands at harmonics of the fundamental frequency.

I tested the ADC-100 on a function generator I knew to have distortion on its sinewave function. When viewed as a waveform, it was quite difficult to see the effect of the distortion. But when looked at on the Picoscope spectrum analyser, the distortion was very obvious.

The frequency range you want to examine can be set, giving increasingly higher resolution as the band becomes narrower.

The frequency and amplitude of a signal can be displayed by simply moving a cursor to the required position on the display. The display can also be saved to disk and printed out. Settings for the spectrum analyser can also be saved and recalled as needed.

Digital meter

Because the ADC-100 has two inputs, the software can display two digital meters on the screen at the same time. The default setting is to measure voltage. The digital display giving the readout is large, and even on a laptop computer, easily read from a distance.

Underneath the digital display is a bargraph that shows the minimum and maximum values read over the period. This will be a thin line for a DC value and a wide bar showing the peak-to-peak values for an AC signal. A typical screen display with two meters is in Fig.4.

Each meter can measure AC or DC voltage, decibels and frequency. The meters are autoranging and can be set to read different functions.

Summary

As you can see, the ADC-100 is a most versatile unit. When combined with a portable computer it can fulfill a wide range of measuring functions, including a data logger. It's easy to use, and can do things many instruments can't, including giving a printout of waveforms and values.

The recommended retail price of the ADC-100 is $495 (ex tax) or $577.82 (incl tax). The ADC-100 and the complete range of Pico Technology data loggers are available from Emona Instruments, 86 Parramatta Road, Camperdown 2050; phone(02) 519 3933. ❖

Data Acquisition and Computer Control

Serial ports run at 921.6kb/s

Hayes Microcomputer Products has released an enhanced serial port system, comprising a card called the ESP Communications Accelerator and software called ESP Speed Multiplier. ESP stands for 'enhanced serial port'. The software includes a range of drivers that enable existing communications applications to multiply serial port speeds to achieve a throughput of 230.4kb/s, 460.6kb/s and 921.6kb/s. The software includes drivers for Windows, DOS, Netware and OS/2 environments.

The software works with an ASIC on the Communications Accelerator. Users with modems or ISDN terminal adaptors that support up to 230.4kb/s or higher can select options that multiply application throughput speeds by two, four or eight times. This makes it possible to take full advantage of modems with enhanced implementations of V.42bis, such as the Hayes Optima 288 V.34/V.FC + fax, for throughput up to 230.4kb/s.

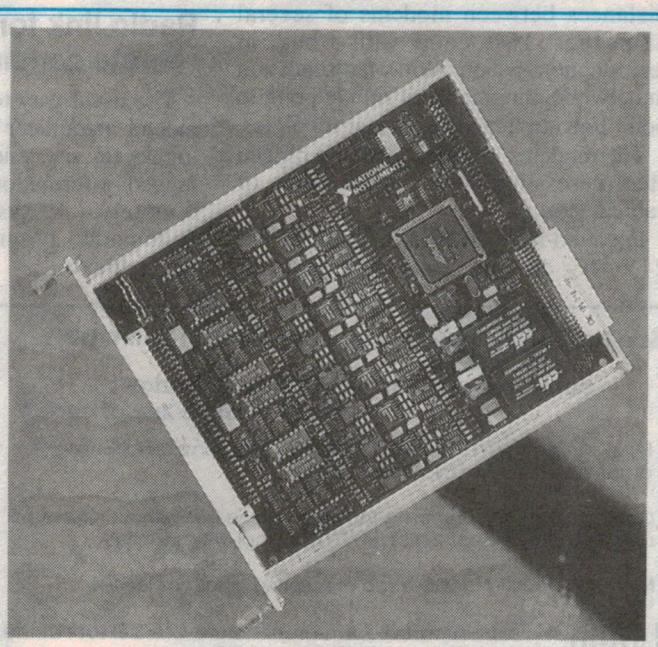
Eight channel filter module for SCXI

National Instruments has announced an eight channel elliptic lowpass filter module for the company's SCXI data acquisition (DAQ) and signal conditioning product line. The SCXI-1141 is ideally suited as an anti-aliasing filter and multiplexer module for National's plug-in DAQ or SCXI digitising hardware.

Each channel features a differential instrumentation amplifier with software programmable gains and input auto zeroing. Each channel also features an eighth order elliptic lowpass filter that provides a very sharp 'brick wall' response with a rolloff of 135dB/octave, making these filters ideal for anti-aliasing applications.

By using a combination of analog filters and switching capacitor filters, the module offers the flexibility of 10,000 discrete software programmable cut-off frequencies while maintaining the performance of traditional continuous time active filters. The SCXI-1141 maintains accuracy with DC compensation circuitry, which removes the offsets of the filters, while an onboard EEPROM stores calibration constants for the amplifiers.

For further information circle 201 on the reader service coupon or contact National Instruments Australia, PO Box 466, Ringwood 3134; phone (03) 879 9422.



For further information circle 202 on the reader service coupon or contact Hayes Microcomputer Products, Level 10, 201 Miller Street, North Sydney, 2060; phone (02) 959 5544.

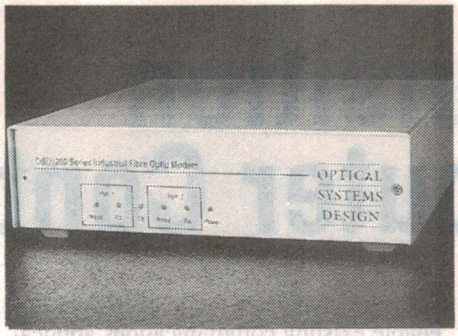
Industrial fibre optic modems

The new OSD1200 series of industrial fibre optic modems from Optical Systems Design interface with many programmable logic controllers including Modicon, Square-D, General Electric, Allen Bradley, Texas Instruments, Siemens and Honeywell.

The units enable a wide variety of network configurations to be implemented. For example, bus, passive optical star and ring structures are all supported with distances between modems of several kilometres. They come with a built in test function, which allows fault location in networks ranging from simple point to point links to large ring or star topolgies.

The modems are packaged in a rugged steel case suitable for stand alone or cabinet storage.

Powered from 240V AC, 115V AC, or 24V DC, the modems work with all



common multimode fibre sizes. OSD can supply units to operate with single mode fibre if required.

For further information circle 204 on the reader service coupon or contact Optical Systems Design, PO Box 891, Mona Vale 2103; phone (02) 913 8540.

Radio link for remote sensing

The usual way to monitor an environmental parameter is to install a data logger on site, and to later retrieve the logged information either manually or remotely. A system from McLean Automation provides an alternative to this method.

The system is basically a radio link smart system integrated with solar power that allows data to be directly logged to the hard disk of a remotely placed (up to 3km) suitably equipped PC. The sensor and solar powered radio link are integrated on a low cost UV stabilised plastic platform.

An example is a floating buoy, equipped with a three wire temperature sensing string for detecting thermal gradients in water columns. The individual sensor string elements are accurate to 0.1° and the small amount of cabling gives a lower cost alternative to waterproof multipole connectors needed by discrete thermistor chains.

Unique to this way of data gathering is a locally written software tool called *Porthole*.

The program shows all parameters in real time as data is being stored on the hard disk. All data read from the hard disk is scrolled through the software, making the system ideal for closing the control half of the monitoring-control loop, even though the sensor is remotely located.

For further information circle 203 on the reader service coupon or contact Mc-

Lean Automation, PO Box 70, Freemans Reach 2756; phone (045) 796 365.

16-bit data acquisition boards

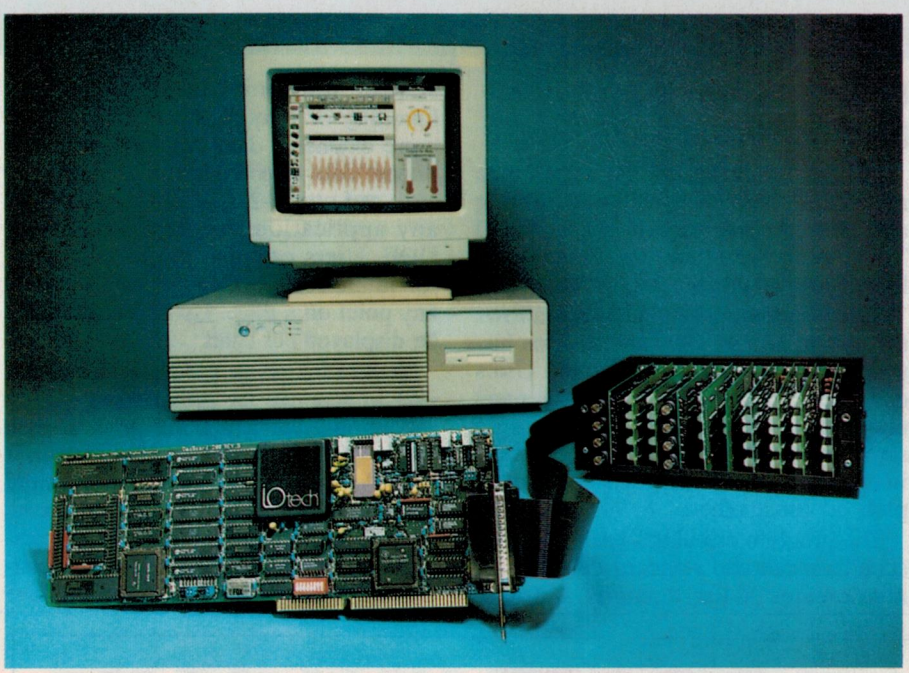
The DacBoard/200A and DaqBoard/216A are IOtech's latest additions to its DaqBoard series of plug-in data acquisition boards for desktop PCs. The 16-bit ISA-bus based boards offer high speed multi-channel performance, and wide ranging software and signal conditioning support.

The boards provide 10us per channel scanning over their 16 on-board analog input channels, and maintain that same performance over their 256 potential expansion channels.

They also provide a 512 location scan sequencer that allows users to select the analog channel sequence and associated gain at random. DacBoard/200A has digital I/O and counter/timer channels, while the DaqBoard/216A does not.

The boards provide three levels of software support: DOS and Windows programming language drivers and VBX (Visual Basic eXtension) custom control, Windows based setup and acquisition applications, and drivers for third party icon based software packages.

The DaqBoards can be expanded to their full 256 channel capacity via IOtech's DBK series of low cost, compact signal conditioning options. The DBK series includes cards and modules for thermocouples, RTDs, LVDTs, high voltage, current, frequency, acceleration and pressure, as well as functions such as isolation, lowpass filtering, and simultaneous sample and hold. All DBK series signal conditioning products can be AC or battery operated and are housed in compact enclosures.



For further information circle 207 on the reader service coupon or contact Scientific Devices, 2 Jacks Road, South Oakleigh 3167; phone (03) 579 3622.

Fluke's trend plotting software

Philips Scientific & Industrial has released a comprehensive trend plotting and analysis software package called Trend Link for Fluke, for Fluke's full line of data acquisition equipment.

The Windows based software allows the user to access, view and analyse historical and real time data on a PC. Users can view data from analog measurement channels simultaneously on a single screen and plot one or multiple channels in real time, even superimposing channel plots on one another.

The program calculates basic statistics such as mean and standard deviation. It also creates X-bar R charts and X-Y scatter diagrams (temperature vs humidity or frequency vs voltage). For more extensive data analysis, users can import data directly into a spreadsheet, such as Lotus 1-2-3, Microsoft Excel, or any application software supporting DDE. Users can also record comments for future reference by tagging notes to any point on a trace. Up to 32 traces can be displayed per chart.

Trend Link prints plots and allows the user to generate the presentation quality reports and cut and paste plots of data into a Windows based word processor. It provides time stamps with millisecond resolution, allowing the user to locate the precise piece of information in question. The software also includes a deadbanding range that allows users to save hard disk space by recording and saving only the data that falls outside normal process limits.

For further information circle 205 on the reader service coupon or contact Philips Scientific & Industrial, 34 Waterloo Road, North Ryde 3113; phone (02) 888 8222.

400kHz data acquisition board

The DAQ-1200 range of data acquisition boards from Quatech include the DAQ-1201 and DAQ-1202, with programmable gains of 1, 10, 100, 1000 and 1, 2, 4, 8 respectively.

Both boards have 16 channel single ended or eight channel differential ended analog inputs, with 12-bit resolution and a maximum sample rate of 400kHz. The input voltage is jumper selectable for either unipolar or bipolar. Data acquisition is supported beyond the normal 64K DMA boundary with two alternating DMA channels. A jumper selection is available for analog expansion up to 256 channels.

The analog I/O includes eight digital I/O through the main DB37 connector, with a further 24 digital I/O available through a secondary DB37 connector. In addition, two 12-bit D/A and three 16-bit counter/timers are provided. There are two FIFO buffers on board: a data FIFO and a scan list FIFO. The data FIFO provides a cushion for the steam of data coming from the output of the A/D conversion. The scan list FIFO is used for scanning the input channels with their corresponding gains. Any sequence of scanning can be programmed and up to 256 channel scanning can be implemented.

The DAQ-1200 can be installed in any available I/O base address location without conflicting with other installed devices. The board can be enabled or disabled, and interrupt levels IRQ2-7, 10-12, 14, 15 are register selectable. The DMA channel selection is also done by the software.

The software drivers provide support for various programming languages such as Microsoft C/C++, QuickBasic and Turbo Pascal. A Dynamic Link Library (DLL) is furnished for all kinds of programming languages under Microsoft Windows. An optional Visual Basic Control (VBX) is also available and third party software such as Labtech Notebook and Snap-Master support the DAQ-1200.

For further information circle 206 on

the reader service coupon or contact Interworld Electronics, 1000 Glenhuntly Road, Caulfield South 3162; phone (03) 563 5011.

Graphical data analysis software

DADiSP ver 4.0 from DSP Development Corporation is a scientific data analysis and visualisation software package designed exclusively for scientific and technical applications in laboratory automation, data acquisition, image processing, signal processing, computer aided engineering and testing.

The new release extends the capabilites of DADiSP to collect, analyse and display scientific and technical data in a format that is intuitively understood by scientists and engineers.

Important additions to the software include native Microsoft Windows and OSF Motif GUI standards, DDE and SPL, a complete programming language. Expanded features of the program include use of variables, improved printing capabilites and on-line documentation. DADiSP is a true Windows version, incorporating the use of standard dialog boxes for file selection, printer setup, feature customisation and other standard cross application operations such as cut and paste.

Version 4.0 includes Dynamic Data Exchange (DDE) in Windows through command lines and also through pull-down menus. DDE is an inter-program communications protocol that allows disparate applications to easily exchange data.

A complete programming language called series programming language (SPL) has been introduced in version 4.0. SPL is modelled on the C language and provides programming facilities that include user defined functions, looping and iteration, conditional statements, array references and variables.

Printing capabilities have been improved and plot titles, legends, multiple scales, selectable fonts and a preview mode have been added. Point and click control over almost every aspect of the printing process makes output customisation easy. Postscript, HPGL, Metafile and native bitmap formats are supported.

For further information circle 208 on the reader service coupon or contact Interworld Electronics, 1000 Glenhuntly Road, Caulfield South 3162; phone (03) 563 5011. ❖

Silicon Valley NEWSLETTER

New superconductor from Los Alamos Lab

Scientists at the Los Alamos National Laboratory in California have created a new kind of superconducting film that, when produced in wire form, can carry 100 times more current than any copper-based wire. The new film is much less brittle than other new high-temperature superconductor materials, making it far simpler and less costly to manufacture. And in another critical advantage, the new material is able to maintain superconductive qualities even when exposed to high magnetic fields.

The film, which is flexible enough to be wound into electrical cable, constitutes a 'major superconductivity breakthrough', said Christine Ervin, Assistant Secretary of the Department of Energy, which funds the Los Alamos lab. "The commercial opportunity and energy-saving potential of this discovery are huge."

The film conducts up to one million amps per square centimetre of cross-section. Regular copper wire, by comparison, carries less than 800A.

The new film may prove particularly helpful in medical applications such as nuclear magnetic resonance imaging devices (MRI), where high magnetic fields have rendered other superconductor materials useless.

News of the breakthrough development was delayed until the laboratory was able to process the patent application, as it hopes to attract the interest of manufacturers in cooperative commercial ventures to exploit the extraordinary properties of the tape.

So far, the laboratory has made lengths of the tape no longer than two inches. But scientists believe there is no major impediment to making longer pieces, and eventually to manufacturing the tape in continuous lengths.

Pioneer's Video CD allows recording

Pioneer Electric has announced the development of the first video CD disc which also allows users to record video and other information. The new Pioneer video disc, which is capable of storing up to 130 minutes of full-motion video, is based on the industry standard design proposed by Toshiba.

A Pioneer spokesman said the company's new CD takes the Toshiba technology a step further, because it is the first capable of recording data. Pioneer sees software makers as its primary customers for the new disc, he said.

Video CDs are expected to replace much of the VCR market in the future. Since December, Toshiba and Sony have been vying for support for their respective designs from electronics manufacturers and movie and television producers for their competing video CD designs.

Toshiba's effort has received support from Time Warner, Samsung, Matsushita, Thomson, Hitachi, Pioneer, Mitsubishi and Zenith. Sony's design is backed by Philips Electronics, which co-developed the format.

Digital radio chip from National

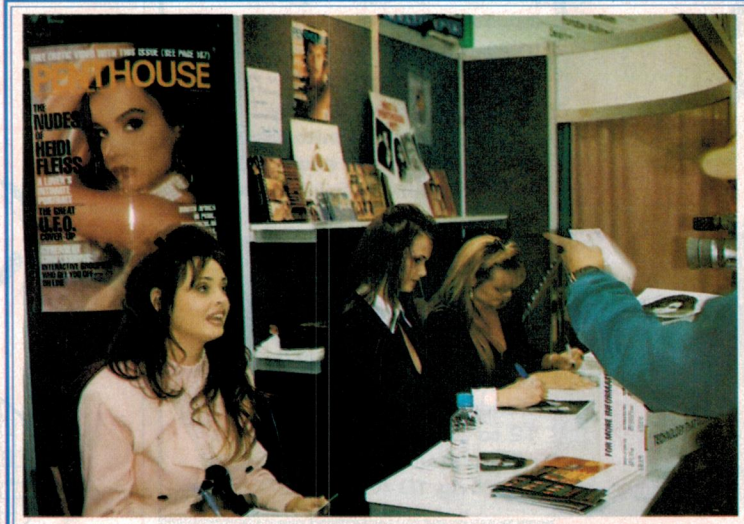
An advanced chip techology developed by National Semiconductor in Santa Clara is expected to make possible new generation of digital radios, which will deliver CD-quality sound. In addition to improving sound quality of both AM and FM stations, the new chips will enable radio broadcasters to provide services like digital paging to anyone with the new kind of radio.

The new system is also compatible with older analog radios, so car owners can add the feature to their existing car stereo.

Norm Miller, director of business development for National Semiconductor, said the USA Digital Radio consortium, a group of major broadcasters, has been working on the digital radio technology for five years. National Semiconductor provided some key technology for correcting errors in digital signals and compressing the signals into an easily transmitted format.

Essentially, the analog radio signals are converted into digital data packets and transmitted to a car or home radio, where they are decoded. Broadcasters would convert to the system by adding a US$20,000 to $30,000 exciter to their transmission stations, but won't have to revamp their entire transmission network.

Miller said that consumers can expect to pay about 15% more for radios that contain National's chips. But new



Another picture in our 'It could only happen in America' series: At a recent computer show, Penthouse magazine had some of its 'Pets' on display, and also available to sign promotional photos. At least it distracted the attention of some show-goers from the high tech equipment.

radios based on the chips won't be available for another 15 - 18 months, he added.

Two tests, one involving a CBS radio station atop the Sears Tower in Chicago, and another at a Gannett radio station in Cleveland, Ohio, have proven that the system works, Miller said.

Small firm patents 'pointing stick'

Incontrol Solutions, a small Oregon company, has been granted a US patent for a pointing stick device that looks and functions like IBM's popular TrackPoint, used to control the on-screen cursor on ThinkPad computers. The development will enable PC and other computer makers to incorporate TrackPoint-type cursor control devices without having to pay a royalty to IBM.

IBM's TrackPoint system uses a small rubber-capped stick in the middle of the keyboard, between the G, H and B keys. The pointer is controlled by the index finger of either the left or right hand.

By comparison, the Incontrol device, called 'Button Mouse' uses a pointing stick that passes through a hole at the edge of the B key. From a user's point of view, the red-capped stick is barely distinguishable from the IBM product.

IBM has allowed other manufacturers to license its TrackPoint system. Toshiba, Texas Instruments and other major producers have begun making machines with TrackPoint II devices licensed from IBM and Lexmark, an IBM spinoff. Roughly half the estimated five million portable computers to be sold this year are expected to have TrackPoint-like devices.

IBM officials said they don't think Incontrol will have a case to seek royalties from IBM, as the company claims to have sufficient patents on its TrackPoint technology.

Chip equipment makers see boom

As semiconductor manufacturers struggle to increase capacity, the companies delivering the multimillion-dollar tools needed to produce ICs are experiencing an unprecedented boom in sales and orders for their products.

Two major semiconductor equipment companies in Silicon Valley have reported spectacular growth rates, which could put both companies over the billion-dollar sales mark during the coming year.

Lam Research in Fremont, the industry's leading supplier of etching and chemical vapor deposition systems, said its sales grew at the rate of 72% to US$219 million, in the third quarter. At this rate of growth, the company is poised to break the billion dollar mark by the end of the year, to become only the second US equipment maker to do so besides industry leader Applied Materials. As recently as 1991, the company's annual sales were just US$75 million.

Lam's profits during the quarter rose 59% to US$24.8 million, compared to $9.6 million for the same period last year. The company recently announced plans to add more than 1400 new people to its workforce this year, to help meet the booming demand for its sophisticated equipment.

Meanwhile Silicon Valley Group, which has been a leading supplier of advanced lithography systems, reported sales of US$109 million in the most recent second quarter, representing a 27% jump from the preceding first quarter. Profits in the quarter were US$7.5 million, up from $5.3 million in the last three months of 1994.

Toshiba, Samsung team up for 64Mb Flash

In a rare alliance between major memory chip makers from Korea and Japan, Toshiba has entered into an agreement with Korea's Samsung Electronics for the joint development of 64-megabit 'NAND-type' flash memory chips.

The two companies said they will share technological expertise to co-develop a 64Mb NAND flash memory, to be produce with a 0.4 micron CMOS process technology. They said they hope to complete development of the technology by the end of year, with sample shipments starting next spring.

This new round of cooperation between the companies complements a 1992 agreement, under which Samsung developed NAND-type flash memories that are compatible with Toshiba's products in key technical specifications, such as memory cell architecture, chip size and pin configuration.

'Low tech' flat panel display

The world flat panel display market is expected to swell from US$5 billion in 1994 to three times this figure by the year 2000. Although the market is currently dominated by Japanese producers, the United States is preparing for a major assault to become a leader in the market.

Most of the US efforts have focused on a combination of innovative new flat panel designs and the US leadership position in semiconductor manufacturing technology and equipment, to produce superior flat panel displays at lower cost than the active matrix devices out of Japan. It was expected that almost any kind of future flat panel display would be based on designs that essentially make them huge semiconductors, with millions of transistors that control the images on the display surface.

However newcomer SI Diamond Inc. has burst onto the scene with an approach that uses no transistors at all. Its flat panel displays, essentially, are flat cathode-ray tubes, delivering superior picture quality, using much less power, and are relatively simple and inexpensive to produce. They certainly don't require cleanroom environments, and a multitude of multi-million dollar pieces of production equipment.

SI Diamond says its technology also solves the need for high use of energy. Most FPDs are built from a metal base, over which layers of materials are laid.

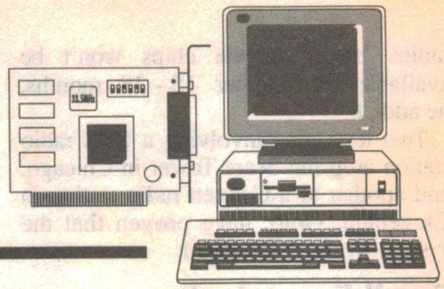
Nalin Kumar, SI Diamond's director of technology, said his invention improves the quality of the cathode film that is layered by sharpening the pits of the electron field on the film. "The nett result is that you have a better cathode that operates at lower voltage, lowering your costs while giving higher performance, brightness and resolution and lower power consumption."

The new display is based on 'field emission' technology, where electrons are emitted from a metal surface (the cathode), under the influence of an electric field. SI Diamond uses a carbon film named 'Amorphic Diamond' on the cathode, allowing the extraction of electrons at a very low electric field. "We can make very sharp features on the cathode film, so there is an enhancement of the electron field at the tips of the features. As a result we can extract electrons at lower voltages", said Kumar.

"Field emission displays are much easier to make compared to active matrix", Kumar noted. "We do not have any silicon-based active devices. We have only three layers of material — the metal contact, the carbon film and the electrical contacts to address each pixel. There are no transistors or diodes on the pixels."

"Essentially, it's a flat TV tube. It has a wide viewing angle and has full colour, because we can use standard cathode ray phosphors, the materials that give you blues and greens." ❖

Computer News and New Products



World Wide Web editor

Firmware Design has been appointed distributor of Hotmetal Pro, an HTML editor for Windows, Macintosh and Sun Motif computing environments. HTML (hypertext markup language) is the standard 'programming language' used to create information and navigation pages on the Internet's World Wide Web.

Of all the myriad Internet services — e-mail, news groups, FTP sites, list servers, real time chat, MUDs and MOOs, — the World Wide Web has captured both the popular imagination and a large number of enthusiasts. The Web is a hypertext system which allows users to jump from one part of a document to another (or to a related document on the same or another server) simply by clicking on a word or an image.

An HTML file consists of the text the user reads plus markup elements which control how that text (and associated images) will appear on the screen. These elements normally consist of a start page at the beginning of a section of text and an end tag at the end.

When words and phrases are to be formatted differently, they are surrounded with the appropriate tags. There are different elements for headings, lists, paragraphs, titles, images, forms, tables and many other parts of a document's structure.

Hotmetal Pro represents these start and end tags on screen with icons, so the user doesn't need to enter these tags manually. The program keeps track of all the appropriate syntax rules, automatically checking that the required structure has not been violated.

The recommended retail price of the program is $279 and it is available now through computer resellers and superstores Australia-wide.

For further information circle 163 on the reader service coupon or contact Firmware Design, 28 Coombes Drive, Penrith 2750; phone (047) 21 7211.

Ethernet adaptor for 100Base-TX

Accton Technology has introduced the new 10Base-T/100Base-TX Network Interface Card. Designed for the emerging fast Ethernet standard, the EtherFast-TX adaptor can support either 10Base-T twisted pair cable or 100Base-TX fast Ethernet of unshielded twisted pair cable. The 22-bit PCI architecture offers improved performance and supports full duplex when using a switching hub.

Accton's new EtherFast-TX network adaptor can accommodate either 10Base-T, 10Base-10 or 10Base-2 connections for conventional Ethernet, or 100Base-TX for fast Ethernet.

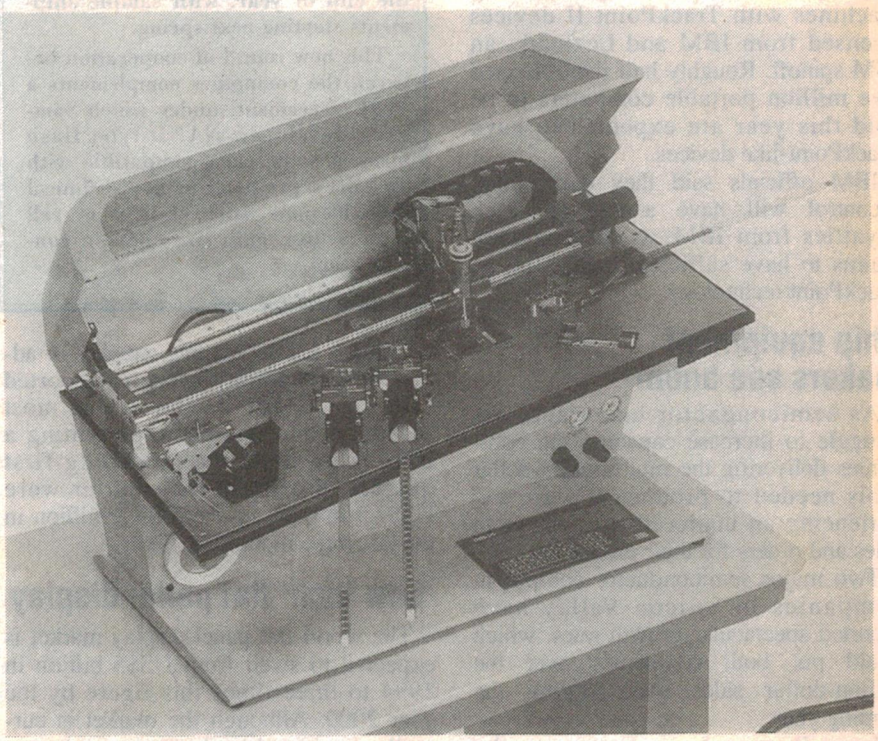
Support for either 10Base-TX Ethernet network speeds is done solely through configurations software, so there are no DIP switches or jumpers to set.

On-board LEDs make it easy to monitor network conditions such as

Programmable SMT component system

Data I/O's ProMaster 2500 which won the 1994 SMT Vision Award, is a fully integrated automated system for handling, programming, testing, sorting and labelling programmable devices. Providing universal support for DIP, PLCC and SOIC packages, the ProMaster 2500 will program, label and sort as many as 550 devices per hour.

Its pick and place system minimises damage to delicate surface mount devices for safe, high yield SMT production and automated tube-to-tube processing eliminates human error, device damage and minimises electrostatic (ESD) damage caused by human handling. The pick and place head rotates devices, so programming and labelling can continue regardless of device orientation in the tube. A high speed printer prints and applies device labels in one operation. The system is controlled by Data I/O's Tasklink Automation software for PC based control.



For further information circle 161 on the reader service coupon or contact Nilsen Technologies, PO Box 30, Concord 2137; phone (02) 736 2888.

Modem has voice mail

Australian modem manufacturer Banksia Technology has released its voice modem product, MyVoiceModem. The product allows the user to access four key features with one phone line; voice mail, fax, data and sound.

The modem can be an answering machine, with multiple mailboxes which allows a caller to be given a menu of mail box options to leave their message. It also lets users remote access their voice mail, to message forward, and to implement call auto-routing, which makes a business appear larger and more professional.

With the Quicklink Messagecentre software (included with the modem) faxes can be sent direct from any Windows application and be received into the mailbox for retrieval from the PC. Remote dial up and fax redirection to another fax device is another key feature.

With the integrated headset and microphone (or by linking the modem with a sound card such as Soundblaster), a user can record a message and listen to voice mail, and also use any standard touchtone telephone to dial. Callmanager also allows users to receive an up to the minute status of call or send mailboxes on the PC screen.

MyVoiceModem supports 14,400b/s data transmission with auto fallback to 9600b/s and lower, ITU V.32bis, V.32, V.29, V.27ter, V.23, V.22bis, V.32, V.17, V.32, MNP2-4 error control, V.42bis and MNP 5 data compression. Other features include full duplex, asynchronous, AT commands set compatible, fax group 3 compatible and Class 1 and 2 fax-modem. Fax speeds at 14,400 or 9600b/s send and receive are supported.

For further information circle 164 on the reader service coupon or contact Banksia Technology, 25 Sirius Road, Lane Cove 2066; phone (02) 418 8566.

busy, link, collision, and data rates. More importantly, the EtherFast-TX is designed to support peripheral components interconnect (PCI) local bus specifications. This means better performance with 100Base-TX connections. The PCI local bus architecture matches the bus speed to the host microprocessor, delivering faster throughput rates on high speed computers such as 80486 and Pentium workstations.

When using a switching hub, the card can operate in full duplex mode and comes with software drivers to support a wide variety of networking operating systems. The RRP of the card is $369.

For further information circle 169 on the reader service coupon or contact Accton Technology, 27 Doomben Avenue, Eastwood 2122; phone (02) 858 2436.

'Designer Power Pack' from Micrografx

Micrografx Australia has announced the availability of Designer Power Pack, an integrated package of award winning graphics products on CD-ROM comprising Micrografx Designer 4.1TE technical illustrator, Micrografx Picture Publisher 5.0 image editor, and Kai's Power Tools 1.0.

Designer Power Pack will have an introductory retail price of $245 until June 30 1995, a saving of $1345 on the previous combined price of both Micrografx products. An upgrade price of $145 is available to current registered users of either of the products.

According to Micrografx, the new price point enables current professional users of competitive graphic packages such as those from Corel and Adobe to add the features and power of Designer and Picture Publisher to their 'graphics tool boxes'. The ease of use and value offered in the Designer Power Pack is also expected to appeal to computer users just beginning to explore PC based graphics.

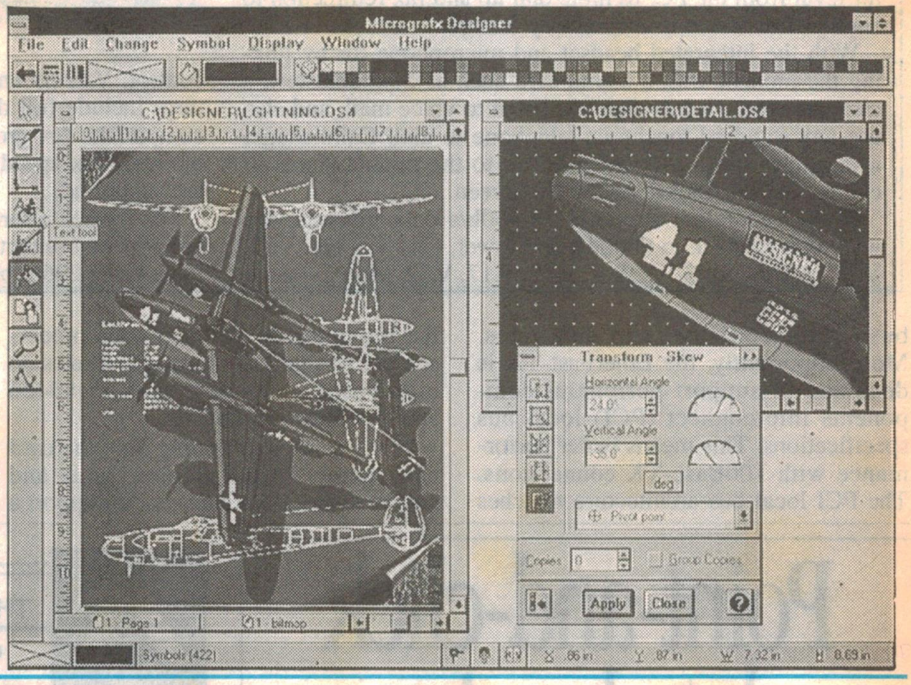
Micrografx Designer Power Pack provides Windows CD-ROM users with three of the industry's leading graphics tools at a price appealing to a wide variety of users. In addition, Micrografx includes 15,000+ clipart images, 300+ stock photos, and 250+ fonts.

Micrografx Designer 4.1 Technical Edition (TE) is an easy, precise and powerful illustration software featuring extensive import/export file formats and symbol creation and editing precise to one micron.

Micrografx Picture Publisher 5.0 is an easy, fast and powerful image editor for Windows that helps increase productivity through innovative features such as the Command List (allowing unlimited undo and task reordering, and Object Layers), which keeps all elements on separate 'layers' for easy movement and editing.

Kai's Power Tool 1.0 is a collection of 33 special effects filters that work with any program like Picture Publisher that supports the industry standard plug-in architecture.

For further information circle 171 on the reader service card or contact Micrografx Australia, 10 Help Street, Chatswood 2067; phone (02) 415 2642.



PCMCIA faxmodem

Banksia has announced its PCCard144 faxmodem. Designed as a portable modem, the device is the size of a credit card (52 x 85 x 5mm) and is currently available for most brands of laptop and notebook computers.

The card allows notebook users to use their computer as a portable office, either connected to a LAN via a PCMCIA slot, or as a modem operating at 14.4kb/s. The faxmodem can also be connected directly to a cellular phone.

The card supports communications speeds of 300 to 14,400b/s, V.42 error correction with V.42bis data compression, it uses a PCMCIA type 2 slot, and supports class 2 fax software under the group III fax standard with send and receive fax speeds up to 14.4kb/s.

For further information circle 162 on the reader service coupon or contact Banksia Technology, 25 Sirius Road, Lane Cove 2066; phone (02) 418 8566. ❖

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Wood For Chips – The CMOS Listing!

We started the full semiconductor listing back in October. We are repeating sections in response to your requests. Call us if the device you want isn't listed!

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SINGLE CHANNEL UHF REMOTE CONTROL SC Dec. 92, one Tx and Rx: **$45**, extra Tx **$15.**

4-CHANNEL UHF REMOTE CONTROL KIT: Two Tx & 1 Rx **$96.**

LOW COST 1-2 CHANNEL UHF REMOTE CONTROL compact keyring transmitter kit, 1/2 million codes, receiver has 2A relay contact output, PCB and all components kit. 1 channel Tx kit **$10**, 2 channel Tx kit **$16** Rx kit **$20** extra components for 2 channel Rx operation (extra decoder IC and relay) **$10**

MASTHEAD AMPLIFIER KIT: Two PCBs plus all on-board components: Low noise (uses MAR-6 IC), covers VHF-UHF, **$18**

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Brand new Hitachi LM215 400 X 128 dot matrix liquid crystal displays in an attractive housing. These have driver ICs fitted but require an external controller. Effective display size is 65 x 235mm. Priced at less than 10% of their real value: **$25 ea. or 3 for $60**

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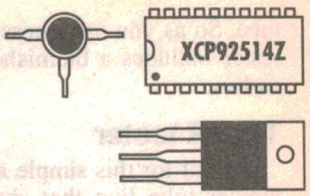


KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

20-pin Flash microcontroller

Atmet Corporation has introduced a proprietary, high performance 20-pin Flash based microcontroller.

The AT89C1051 has 1K bytes of on-board Flash memory and is aimed at cost sensitive consumer related markets. "This device," explained John Bryant from Atmel, "is perfect for appliances, personal entertainment systems, a host of applications within the home, and various functions within an automobile, including remote car entry.

The device brings processor power to applications where the expense incurred previously could not be justified." The controller contains 64 bytes of random access memory, 15 I/O lines, a 16-bit timer/ counter, a three source two level interrupt architecture, a precision analog comparator, an on-chip oscillator, and clock circuitry.

The AT89C1051 is a memory reduced version of the industry standard 80C51 device, stuffed into a 20-pin package, and contains the same internal core circuitry as the 80C51. The micro-controller is an 8-bit device with internal Flash read only memory that does not require an ultraviolet erase step.

It uses static rather than dynamic internal logic, which allows it to operate at low clock speeds and even allows the clock to be stopped without any loss of data. Because the microcontroller uses the same database as the Intel MCS-51 family, it has the same instruction set and uses the same off the shelf tools for development, debugging and testing.

For more information circle 272 on the reader service coupon or contact GEC Electronics Division, 38 South Street, Rydalmere 2116; phone (02) 638 1888.

100MHz Pentium cache RAM

Integrated Device Technology has introduced a secondary cache solution for 100MHz Pentium processor applications. The IDT71420 synchronous burst CacheRAM enables the highest level of Pentium processor performance by providing a zero wait state secondary cache with 9ns access time and burst mode performance.

100MHz and 90MHz Pentium processors require cache SRAMs with 9ns and 10ns clock-to-data performance, to match the processor cache bus rates of 66MHz and 60MHz respectively.

With clock to data access times as fast as 9ns, the IDT71420 offers a performance with a synchronous burst mode specifically tailored for Pentium systems, and enables the highest level of performance in Pentium processor secondary cache applications.

To fully make use of the burst address features of the Pentium processor, the IDT71420's burst mode functionality provides four address cycles of data with each address presented to the CacheRAM. This is essential in achieving a zero wait state, or 2-1-1-1, secondary cache performance as it provides the fastest possible data access during the four read cycles of the burst sequence.

The IDT71420 uses the chip select input to control the address status input from the processor, allowing designers to take advantage of the address pipelining mode of the Pentium processor.

For further information circle 278 on the reader service coupon or contact GEC Electronics Division, 38 South St, Rydalmere 2116; phone (02) 638 1888.

Triple 256 x 8 RAM DAC

The Bt497/8 from Brooktree is designed for high performance, high resolution colour graphics applications. The architecture enables the display of true colour 1600 x 1280 bit-mapped colour graphics at 76Hz refresh rates. The wide input pixel port and internal multiplexing modes enable PLL compatible interfacing to the frame buffer, while maintaining PLL generated 220MHz, or

Dual op-amp has 900MHz BW

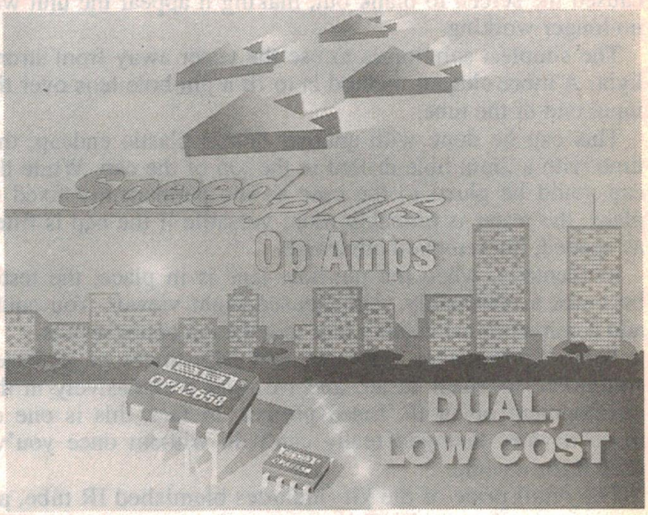
The OPA2658 from Burr Brown is a dual ultra-wideband, low power, current feedback operational amplifier featuring a high slew rate, and low differential gain/phase errors. Its low 50mW power dissipation combines with a bandwidth of 750MHz to make the device suitable for medical imaging, high resolution video, communications, pulse amplifiers, and high speed signal processing applications.

The op-amp's current feedback design allows a large signal bandwidth, even at high gains, and is internally compensated for unity gain stability.

It operates on a +/-5V power supply, making the device suitable for portable applications.

Key applications include a 900MHz unity gain stable bandwidth, 50mW power dissipation, -75dBc harmonics at 5MHz, 1700V/us slew rate, and 0.01%/0.03° differential gain/phase error. It comes in 8-pin DIP and SOIC packages, and is specified over the extended industrial temperature range of -40°C to +85°C.

For further information circle 271 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone toll free (008) 335 245.

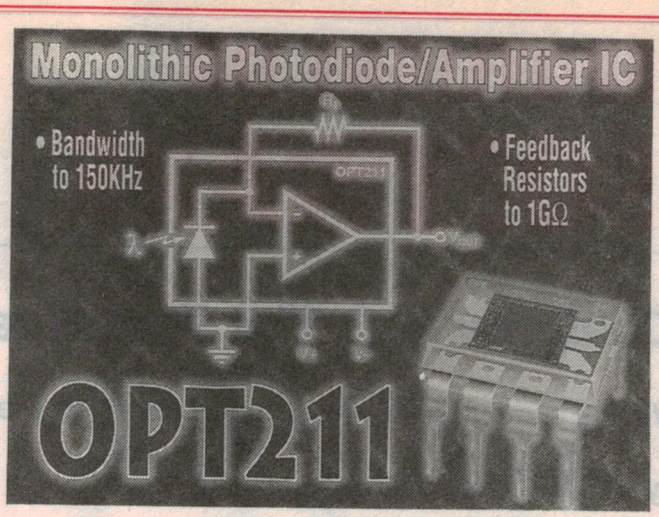


Photodiode amplifier has 150kHz bandwidth

Burr-Brown's new OPT211 is a monolithic photodiode with on-chip FET input transimpedance amplifier, providing wide bandwidth at very high gains. Uncommitted input and feedback nodes allow a variety of circuit options for maximum versatility. The photodiode is ideal for a wide range of light sensing applications including smoke detectors, position and proximity sensors, medical and laboratory instrumentation.

Its on-chip transimpedance amplifier eliminates the problems commonly encountered in discrete designs such as leakage current errors, noise pickup and gain peaking.

The device's dielectrically isolated fabrication achieves very low dark errors (2mV max). Direct access to the detector's anode allows photodiode bootstrapping for 150kHz bandwidth. It operates over a supply range of +/- 2.25V to +/-18V and quiescent current is 400uA. Other key specifications include a 2.29 x 2.29mm photodiode, and responsivity of 0.45A/W at 650nm.



For further information circle 277 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone toll free (008) 335 245.

externally provided 220MHz video data rates required for high refresh rate, high resolution colour graphics.

The device supports PLL pixel clock generation, and a variety of frequencies using an M/N divisor scheme. This decreases system cost due to the elimination of the multiple crystal oscillators used to support a variety of monitor and refresh rates. The IC contains three 256 x 8 colour lookup tables, three 256 x 8 gamma ROMs, triple 8-bit video D/A converters, a programmable 64 x 64 x 2 cursor, and a fully programmable video timing generator.

The window identification index addresses a colour model table which determines the description of the pixel data. For example, separate windows displaying 24-plane true colour, 8-plane pseudocolour, and 24-plane double buffer true colour can exist within a single frame.

For further information circle 274 on the reader service coupon or contact Zatek, PO Box 397, West Ryde 2114; phone (02) 874 0122.

Wideband voltage feedback op-amp

Burr-Brown's new OPA650 and OPA2650 are single and dual wideband voltage feedback operational amplifiers featuring low power, high dynamic range, fast 12-bit settling, and low differential gain/phase errors. The low cost combined with high performance makes the devices suitable for video, imaging, medical, test equipment, and communications applications. The voltage feedback design offers a true differential input stage, which lends itself to easy implementation for all amplifier, differential amplifier and active filter designs.

Key specifications include 560MHz unity gain stable bandwidth, 50mW power per amp, -77dBc harmonics at 5MHz, 20ns settling time to 0.01%, and 0.01%/0.03° differential gain/phase errors. Both the devices come in 8-pin PDIP and 8-pin SOIC packages and are specified over the -40°C to +85°C temperature range.

For further information circle 276 on the reader service coupon or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone toll free (008) 335 245. ❖

3A switching transistors in SOT23 package

The FMMT617 and FMMT717 'super SOTs' are claimed to be the first SOT23 packaged switching transistors capable of handling a continous collector current of 3A. With a maximum saturation voltage of 200mV, the new surface mount devices are suitable for battery powered applications. Compared with the larger SOT89, SOT223, D-PAC and TO220 packaged devices, the super SOTs save space on PCBs and can dissipate 625mW of power.

Supporting a peak current of 12A and assuring a minimum gain of 80, the FMMT617 NPN transistor can be used as a driver for stepper motors, IR LEDs and moving message displays. At a continuous current of 3A, the transistor has a typical gain of 320 with a typical saturation voltage of 250mV, making it suitable for low voltage DC/DC conversion and power supply switching applications.

The FMMT717, used in conjunction with the FMMT617 in H-bridge configuration, finds typical application in burglar alarm siren drivers, disk drive and other motor driver applications. The FMMT717 PNP device has a saturation voltage of 220mV at a continous collector current of 2.5A with a typical gain of 70 at a peak rated current of 10A.

For further information circle 273 on the reader service coupon or contact GEC Electronics Division, 38 South Street, Rydalmere 2116; phone (02) 638 1888.

SPOTLIGHT ON SOFTWARE

Designer 4.1: The Technical Edition

When a computer drawing program says it's for technical people, we just had to have a look...

by PETER PHILLIPS

Ask an IBM compatible user to name the most popular drawing program and it's likely the answer will be *CorelDraw*. And for good reason, as Corel has been around for years, has gone through many revisions and meets the needs of most graphic artists. Of course, anyone into technical drawing will also know about or use *AutoCad*, or one of its lower priced derivatives.

Designer, a drawing program from Micrografx, has been around for quite a few years and offers many of the features of CorelDraw. I first became acquainted with *Designer 3.1* in 1991, reviewing it for the November 1991 issue of *EA*'s sister magazine *Your Computer*.

Although Micrografx didn't make a big deal of it at the time, *Designer 3.1* had quite a few features to suit the technical user, including a range of electrical drawing symbols. But with version 4.1, it seems Micrografx has decided not to merely compete with the latest version of *CorelDraw*, but to offer a drawing program with a difference. And that difference is summed up in the name: Technical Edition. However, despite its technical 'bent', *Designer 4.1* is apparently not intended as competition for *AutoCad*.

This new version is the second revision since 3.1 and some readers may have taken advantage of a recent sale where *Designer 4.0* could be picked up for $199.

There are differences between 4.0 and 4.1, including a smaller range of shading effects and none of the 3-D effects available in 4.0. Presumably this is to make way for technical enhancements, although I suspect it's also because both these features required resources beyond most computers.

Otherwise, version 4.0 and 4.1 are rather similar, but if you are upgrading from 3.1, then you're certainly in for a surprise as this new version is vastly different.

Overview

Designer 4.1 is a very large and complex program. It is supplied on a CD-ROM disc and also on nine 3.5" floppies, although quite a lot of the supplied clip-art is only available on the CD-ROM disc. The program chews up computer resources, and anything less than a '486 is not recommended. The recommended resources include 16MB of RAM and at least 25MB of hard disk space.

The screen display is entirely different to *Designer 3.1*, and resembles the minimalist display of Corel. However, like most current Windows-based software, the function of each icon is identified by a 'text balloon' when you point to an icon.

There are three main aspects to *Designer 4.1*: the drawing package, the technical features and the clip-art. The most complex of all these is the drawing package, so we'll start by describing a few of its many features.

Drawing

In most cases, it's possible to do reasonably fancy drawings with a basic drawing program. I use the drawing program in *AmiPro*, and over the years I have used this program to illustrate three electrical text books and a host of technical articles.

In fact, virtually all the circuits in our 'Circuit and Design Ideas' section are drawn in AmiPro.

But sometimes you need something more — like shading, better shaping control, text manipulation, exotic fills and so on. It's here that either Designer or Corel step in.

Most Windows-based drawing packages let you move a drawing from one program to the other via the clipboard, so a basic drawing done in say AmiPro, can then be moved to Designer or Corel for further treatment.

Designer 3.1, unlike Corel, has the ad-